

ANALYTIC STUDY
OF A GROUP
OF FIVE AND SIX
YEAR OLD CHILDREN

TOWN

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ANALYTIC STUDY OF A GROUP OF FIVE AND SIX-YEAR-OLD CHILDREN

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EDITOR'S FOREWORD

This is a preliminary investigation for a more comprehensive program the Research Station has outlined, covering a series of years, and aiming to determine *what kind of children the Iowa homes are sending to the Iowa schools*. Dr. Town made a series of observations and experiments from many angles on 52 children during the first months of their school life, with the direct help and coöperation of the staff of the Station, members of the Medical and Dental Colleges, the Graduate College, and the school authorities of Cedar Rapids.*

Few physical, mental and social tests are available for use with such young children, and many of those which are applicable are not standardized. Several of the tests were found to be too easy and showed an undistributed maximum score; others were too difficult and showed an undistributed zero. With a few cases there resulted a complete failure to understand the directions of the test, and no score was made. These facts show that some new experiments and different standards with more specific technique will be necessary for the further studies which are contemplated.

In the absence of norms, the performance of each child is compared with the percentile score of the group. For convenience of treatment, the psychological tests are grouped under descriptive terms such as imagination, memory and perception. This should not be taken to mean that any general ability which could be designated by such terms, was being tested. The charts and type cases attempt to give a synthetic, synoptic picture of twelve children.

*The medical examination was made by Dr. J. J. Terrall, a local physician of Cedar Rapids. The dental examination was made by Dr. E. A. Rogers and Dr. R. W. Rogers of the University of Iowa College of Dentistry. The tests for auditory acuity and pitch discrimination were given by Mr. H. M. Halverson of the Department of Psychology, University of Iowa. The speech examination was made by Miss Sara Stinchfield of the Iowa Child Welfare Research Station. The other measurements were made by Dr. Clara H. Town. Special mention should be made of the assistance of Dr. Carl E. Seashore and Dr. Ellsworth Faris of the University in planning and carrying out the investigation during the Director's absence in the service of the United States Army. Dr. Town was unable to complete the investigation during her appointment as Research Associate. The Director, therefore, assumes the responsibility for a number of minor changes and eliminations which it seemed desirable to make when preparing the manuscript for publication. In this work he has had the assistance of Dr. Lorle I. Stecher. Dr. Town, who is now in France, has read and approved the final manuscript.

The investigator was given as much freedom as the general program would permit, and the tests selected, the traits measured and the technique in several instances have been determined by her interest and training and the accessibility of the materials and methods.

The present problems of the Research Station lie in two distinct directions: (1) The elimination of some of the tests, the addition or amplification of others, the further consecutive scientific analysis of the most fertile experiments, and the examination of additional pre-school children, with a view to an ultimate survey of the complete child from several aspects, and (2) the organization and stimulation of a remedial program for these and similar children who are representative of the large mass of five and six year old children of Iowa. It is a most significant fact in this *Study* that not a single child was found to be free from mental or physical defects.

BIRD T. BALDWIN

Office of the Director
Iowa Child Welfare Research Station
University of Iowa
October 1, 1920

ANALYTIC STUDY OF A GROUP OF FIVE- AND SIX-YEAR- OLD CHILDREN

I. INTRODUCTION

As a part of the year's research for 1918-1919, the Iowa Child Welfare Research Station planned a comprehensive study of little children who had just reached school age but who had not yet been modified by school influences. The underlying thought was, that could the schools obtain, when a child is first entered, an adequate knowledge of his abilities and disabilities, strengths and weaknesses, both mental and physical, they could make a more intelligent attempt to plan the first years of his school life.

That improvement is needed in the school procedure during these first formative school years is evidenced by the large number of children who repeat the kindergarten and the first and second grades. In the 1915-1916 report of the Cedar Rapids schools the percent of nonpromotions in the kindergartens is given at 27.4 per cent, in B-first 16.6 and in A-first 16.8. In the 1918 school report for Denver, Colorado, the retardation in the first grade amounted to 44 per cent, and in the second grade, 52 per cent. This retardation is based on age. If retardation starts thus early the causes for retardation must already be present, and if these causes are discovered at the beginning of the child's school life there is a possibility of eliminating the retardation before permanent harm is done.

As it seemed impossible to secure the children for the purpose of study in any other way than through the public schools it was decided to direct our studies to classes just beginning school, classes composed of children who, though they had entered school, were very nearly home products. The general plan of the Research Station is to study several such groups in representative sections of some one Iowa city and later to extend the study to include cities in various sections of the state and also country schools. It is hoped that in this way it will be possible to discover what sort of children the Iowa homes send to the Iowa schools. This study

presents the results from one class in Cedar Rapids, the research extending over a period of six months.

Though not modified by school influence, these children have already been modified by home influence. Each little child of the group is the result of six years of development under a home influence differing from the home influence acting upon every other child of the group. At six years of age, although potentialities of some adult abilities have not yet manifested themselves in conduct, children are already highly differentiated individuals with dominant tendencies of character and temperament. Many innate tendencies have appeared, which have been fostered, curtailed or shunted into diverse channels of activity by the influence of home environment or discipline. Many habits, of both body and mind, have been acquired. In short, at six years, children are already so highly individualized that it is no longer justifiable when referring to them to speak of "the child" but better to speak of "the children."

The plan was not, therefore, to study our children in groups, but to analyze each complex individual in the group. It was part of the plan to learn as much as possible about him physically—the development of his body and its parts, the functionings of his circulatory, respiratory, digestive, glandular and nervous systems, the state of his nutrition, the condition of his sense organs and the adequacy of his motor power and control. It was a part of the plan to learn as much as possible about him mentally—the stages of development of his various mental processes, his habits, instincts, impulses, temperamental tendencies and dominant traits of character. It was also part of the plan to find out what he had experienced during his five or six years of life, on the physical side—his illnesses, his privations, his indulgences, the character of his food, shelter, clothing and general environmental experiences—and on the mental side, the home influences—emotional, aesthetic, intellectual, religious, moral and disciplinary.

This accumulation of facts relating to a child as he was in the beginning and as he has been during the first five or six years when compared with our findings as to what he is at the end of these years should tell something of the experiences and influences which have made him what he is. Such studies when repeated with each of a large group of children should do something toward

pointing out what sort of experiences and influences tend to produce a satisfactory type of six year old and what sort of experiences and influences tend to produce a defective or handicapped type of child.

The collected facts from a small typical group should also contribute to our knowledge of the number of children who are defective physically or mentally when they enter school and to our knowledge of the nature of these defects. They should do much to show whether the defects noted in so many children after two or three years' experience of school life and sometimes attributed to school life itself, are already present in the child prior to any school experience.

The following pages contain a record of the studies made of fifty-two children in one class in Cedar Rapids, Iowa. The report naturally divides itself into sections on the physical findings, (physical examinations, anthropometric measurements and speech examinations), a section on the mental findings and a section on the social findings, consisting of sketches of individual children. An analysis of the tabulated results of the physical findings brings to light some rather startling conditions. Most startling of all, perhaps, is the fact that every child in the group is in need of physical help of some sort.

II. PHYSICAL EXAMINATION

The physical examination of each child comprised a general inspection of the body,* a medical and dental examination, together with tests for visual and auditory acuity and pitch discrimination.

1. *Medical Examination*

Outline

Skeletal Development

Muscular development

Skin and appendages

Glands

Respiratory System

 Upper respiratory tract

 Rate of respiration

Chest

 Inspection

*The eye color was also classified and recorded according to the directions and chart given in the *Trait Book* published by the Eugenics Record Office, Bulletin 6.

TABLE I (1)

Child Number		Age in Years	Acuity in Vision R	Acuity of Vision L	Binocular Inco-ordination	Auditory Acuity R (Whisper) (a)	Auditory Acuity L (Whisper)	Auditory Acuity R (Audiometer) (b)	Auditory Acuity L (Audiometer)	Pitch Discrimination	Tympanic Membrane Dull R	Tympanic Membrane Dull L	Enlarged Cervical Glands	Enlarged Inguinal Glands	Enlarged Cubital Glands	Tonsils, Enlarged or Diseased	Adenoids, Enlarged	Lungs, Rales	Von Pirquet Test	Pulse Rate	Heart Murmurs	Haemoglobin	Urine, Acid or Alkaline	Urine, Specific Gravity	
1	5	4/10	1/10		+	87	77	0	0	0						+				120			75	Alk. 1030	
2	5	10/10	10/10			108	99	37	27	17						+	+			104	+	95			
3	5	8/10	8/10			97	99	30	25	12			+	+		+	+			80	+	83	Alk. 1023		
4	5	10/10	10/10			108	99	25	23	2			+			+	+			104				Ac. 1010	
5	5	10/10	10/10			97	99	21.3	21	2			+			+	+								
6	5	8/10	4/10		+	87	99	27	27	3			+				+			116		66	Alk. 1020		
7	5	10/10	10/10			76	109	26.6	22.6	12								+		100		75	Alk. 1022		
8	6	10/10	10/10			87	77	27.3	23.3	12			+			+	+			112		72	Alk. 1015		
9	5	4/10	8/10			97	109	27.6	32.3	3												75			
10	6	10/10	10/10			76	77	22	26	8			+			+	+			100		76	Alk. 1026		
11	5	4/10	1/10			97	109	23.5	19	0				+		+			P	104		76	Alk. 1022		
12	5	6/10	6/10			87	99	26	25.6	8	+		+	+		+	+	+		120	+	81	Alk. 1020		
13	6	6/10	6/10			108	80	18.6	20.3	8			+	+		+					+	80	Ac. 1017		
14	6	8/10	8/10			108	109	14.3	23	17				+						128		75	Alk.		
15	7	8/10	6/10			97	109						+					+			112	+	73		
16	5	10/10	10/10																						
17	5	6/10	6/10		+	108	109	21.3	29	3											100		71	Ac. 1018	
18	5	8/10	10/10		+	97	109	24	23.6	3			+	+		+	+					78	Ac. 1008		
19	5	6/10	8/10			108	109	26	25.3	3			+			+					116	+	78	Ac. 1010	
20	5	8/10	8/10			97	109	26	26.6	8											100		76		
21	6	10/10	10/10			108	109	28	29	0			+				+				108		85	Alk. 1035	
22	5	8/10	8/10			108	109	25.6	25.3	12											112	+	73	Alk. 1025	
23	5	8/10	8/10		+																				
24	6	10/10	10/10			108	109	20.5	20.5	2			+	+		+	+	+		112	+	75	Alk. 1026		
25	5	10/10	10/10			108	109	25	25.3	3										100		74	Ac. 1027		
26	5	10/10	10/10		+	108	109	26.3	30	5		+					+			92	+	83	Alk. 1023		
27	5	10/10	10/10		+	65	43	26	27.5	17			+	+								78	Alk. 1020		

TABLE I (2)

Child Number	Age in Years	Acuity of Vision R	Acuity of Vision L	Binocular Inco-ordination	Auditory Acuity R (Whisper) (a)	Auditory Acuity L (Whisper)	Auditory Acuity R (Audiometer) (b)	Auditory Acuity L (Audiometer)	Pitch Discrimination	Tympanic Membrane Dull R	Tympanic Membrane Dull L	Enlarged Cervical Glands	Enlarged Inguinal Glands	Enlarged Cubital Glands	Tonsils, Enlarged or Diseased	Adenoids, Enlarged	Lungs, Rales	Von Pirquet Test	Pulse Rate	Heart Murmurs	Haemoglobin	Urine, Acid or Alkaline	Urine, Specific Gravity
28	5	10/10	10/10		97	109	28.6	24.3	0			+	+		+	+			120		76	Ac. 1025	
29	5	10/10	10/10	+	108	109	28	27	5		+		+		+				120				
30	6	10/10	10/10		108	109	20.6	20.3	12						+	+			112		67		
31	5	4/10	4/10		97	99									+	+			120				
32	7	10/10	10/10		87	80	34.5	31.5	8						+	+					80	Alk. 1026	
33	5	4/10	4/10		108	80	29	27	3			+	+		+	+			120		86	Ac. 1018	
34	6	10/10	10/10		108	109	18.5	15.3	2				+		+	+			112		73		
35	5	6/10	10/10		108	80	24.6	25.3	0			+	+	+	+	+			104		76	Ac. 1026	
36	6	10/10	10/10		97	80	26	29	8			+	+		+	+	+		120		81		
37					97	80																	
38	5	10/10	10/10		97	109	30.5	31.5	17												67		
39	5	10/10	10/10		108	109	29.6	28	0										120		70		
40	5	10/10	10/10		108	109																	
41	5	6/10	8/10																				
42	5	10/10	10/10		108	99	26.6	19	0						+	+			92		73	Ac. 1024	
43	5	6/10	8/10	+	108	99	19.5	27	12		+	+	+		+	+	+		104	+	75	Ac. 1012	
44	5	10/10	10/10		97	109						+	+		+	+	+		104		77		
45	5						30.3	29.3	0			+	+	+	+	+			96		75	Alk. 1016	
46	4																						
47	5	6/10	6/10		97	99	24.3	24.6	0			+	+	+					104	+	72	Ac. 1018	
48	5	6/10	10/10	+			26	25.5	0			+	+						120		75		
49							26.6	28	0														
50	5	10/10	10/10		97	99	27.6	24.3	0			+	+	+	+	+				104		76	
51							27.5	26.6	0														
52	6			+			20	18	12														
53							24.3	28	0														

(a) Norm. Right Ear 92 Left Ear 91

(b) Average Right Ear 25.3 Left Ear 24.8.

TABLE I (3)

Child Number	Urine, Sugar	Urine, Albumin	Urine, Acetone	Urine, Indican	Circumcision Needed	Flat Foot	Bowed Legs	Scoliosis	Lordosis	Scapulae Prominent	Left Handed	Eye Color	Temporary Teeth Lost	Permanent Teeth Erupted	Temporary Teeth Carious	Temporary Teeth Abscessed	Permanent Teeth Carious	Permanent Teeth Abscessed	Extraction Recommended	Mal-occlusion	Cleaning by Dentist Needed	Tooth Brush Owned	Teeth Already Filled
1	0	0				+				+	+	2	0	0	11	0	0	0	0	0	0	0	0
2	0											2	0	0	0	0	0	0	0	0	0	0	0
3	0	0		0								2	0	0	2	0	0	0	0	0	0	0	0
4	0	0				+				+		6	2	6	5	0	3	0	0	0	+	+	0
5												6	2	6	8	0	2	0	0	0	+	+	0
6	0	+		0								2	0	2	4	1	2	0	1	1	+	+	0
7	0	0		0							+	2	2	0	5	1	0	0	1	0	+	+	0
8	0	0		0		+				+		2	2	4	6	0	0	0	0	0	+	+	0
9												2	0	2	14	0	0	0	1	0	+	+	0
10	0	0		0		+						2	2	2	8	1	0	0	1	3	+	+	0
11	0	0						+				2	2	0	2	0	0	0	0	0	+	+	0
12	0	0									+	2	0	6	0	0	0	0	0	0	0	+	0
13	0	0				+						2	4	2	3	0	0	0	0	0	+	+	0
14	0	0				+			+			6	0	2	4	0	0	0	0	0	+	+	0
15										+		2											
16												2											
17	0	0		0								2	0	0	0	0	0	0	0	0	+	+	0
18	0	0								+		3	0	0	2	0	0	0	0	0	+	+	0
19	0	0		0						+		2	0	0	12	1	0	0	1	0	+	+	0
20												3	0	0	0	0	0	0	0	0	0	+	0
21	0	0								+		3	3	4	9	2	0	0	2	0	+	+	0
22	0	0					+				+	6	0	0	9	0	0	0	0	0	+	+	0
23													0	0	2	0	0	0	0	0	+	+	0
24	0	0								+		6	1	4	7	0	0	0	0	0	+	+	0
25	0	0								+	+	4	0	1	11	1	1	0	1	1	+	+	0
26	0	0									B	6	0	0	5	0	0	0	0	0	+	+	0
27	0	0				+		+			+	6	0	0	11	1	0	0	1	0	+	+	0

TABLE I (4)

[illegible]

- Palpation
- Percussion
- Auscultation
- Von Pirquet when indicated
- Circulatory system
 - Pulse rate: standing and sitting
 - Regularity of beat
 - Quality of beat
 - Arteries
 - Veins
 - Heart
 - Blood
 - Wassermann when indicated
- Genito-urinary
 - Examination of urine-sugar, albumin, indican, acetone
 - Sexual abnormalities
- Nervous system
 - Sense organs
 - Deep sensibility: nerve trunks, muscles, sense of position and passive movements, and tension
- Coördination
 - Tremors, tics, automatisms, chorea, convulsions
 - Reflexes
 - Superficial
 - Deep

A number of points merit comment in connection with the physician's findings. In the lung examination, rales were detected in 5 cases out of 43. These are not necessarily an indication of tuberculosis, as rales may be due to an acute and transient disorder only. Only 1 out of 11 children whose parents consented to a Von Pirquet test showed a positive reaction and this was not a child in whom rales had been detected. A positive von Pirquet may, moreover, be obtained after the active tuberculous condition has passed. Enlarged lymphatic glands were present in 41 out of 43 children. This, again, is not to be taken as indication of tuberculosis, since this glandular condition may accompany diseased tonsils or adenoids or decayed teeth, all of which conditions occurred in a large number of this group of children.

In the heart examination, murmurs were found to be present in 11 cases. A heart murmur found in an examination is no more a conclusive proof of organic heart lesion than is the presence of rales a conclusive proof of tuberculosis. Heart murmurs are sometimes the result of anaemic conditions, and to judge of

their significance it is necessary to consult the symptoms indicative of the state of nutrition—the haemoglobin content, the height-weight record, etc. Many pulse rates were rapid, but this was manifestly due to excitement at being examined.

The haemoglobin content was measured with a Sahli haemometer. In a well-nourished individual approximately 14 per cent of the blood stream is haemoglobin. This amount is represented on the scale of the instrument used by 100. Dr. Cabot considers 80 as the average for children from 5 to 15 years, and Dr. Josephine E. Young, in a study of children at the School of Education, University of Chicago, secured an average of 77 for boys from 6 to 11 years, and an average of 80 for girls from 6 to 17 years of age. If our data are comparable with Dr. Cabot's, 30 of our 39 children have a haemoglobin content below the average. Only one of our group reached a content of over 86. This child's haemoglobin was 95. The lowest ratings were 66 and 67; 27 cases fell between 70 and 80 and 8 between 80 and 90. It would seem, however, that the very method of the haemoglobin test would make accurate comparisons between data secured by different individuals almost impossible. The exact matching of color required by the test makes the reading depend upon the accuracy of the color perceptions of the examiner. This accuracy, of course, varies with individuals, and the personal equation is therefore largely contributory to the results obtained. The haemoglobin content, moreover, is only one of many methods of estimating malnutrition, and to be of value should be considered in connection with height-weight, condition of skin, etc. When we compare the haemoglobin content with the height-weight record we find that 18 of the 30 children having a haemoglobin content under 80 are underweight. (Table I.) In connection with all these medical data, it is of interest and value to note the anthropometric records in order to see how a child's general physical development and weight-height index are correlated with the physician's findings.

An effort was made to inform the parents of the results of the examinations, both by parents' meetings and by visits to the homes. Intelligent coöperation in remedying defects was almost always secured. It appeared in most cases that the parents were unaware of the child's condition and expressed great satisfaction that the child was having a thorough examination.

2. *Acuity of Vision*

As the children were still unable to read, it was necessary to use for testing visual acuity an "illiterate test." The E charts on the market are unsatisfactory in two particulars: first, there are so many E's on the chart that a young child has difficulty in centering his attention on the particular E to which the examiner points; second, it is quite possible for some children to learn the order of the positions on the card while the first eye is being tested, which of course vitiates the test for the other eye. To eliminate these difficulties, a set of white cards five inches square was prepared, in the center of each of which was mounted an E cut from the E chart. On the back of the chart was written the amount of vision necessary ($20/20$, $8/10$, etc.) to see that letter at twenty feet, and also the position of the E on the reverse side. The examiner stood at a distance of twenty feet from the child, held the pack of cards in an upright position and exposed one at a time for the child to observe. The child was asked to point in the direction that the E pointed and was given a little practice in doing so at close range before the test was taken. If he failed to grasp the idea of the pointing method, he was given a cut-out E the size of the largest E and asked to hold it so that it looked like the E on the card. One or the other method usually brings a satisfactory response unless the child is an imbecile of the excitable type. The eyes of 47 children were so tested, and 22 (47 per cent) were found to have defective vision. (Table I).

The Maddox rod test for binocular coördination revealed the fact that 4 children who had average acuity of vision by the E test showed marked incoördination of the eye muscles as did also 6 of the 22 who had diminished acuity. Such incoördination would interfere materially with the process of learning to read. These visual defects were present when the child entered school and were not due to strain sustained at school through poor lighting, blackboards, small print, etc. It is obvious that all children should be tested upon entering school in order that such conditions may receive attention before further strain interferes with general health and school progress.

3. *Acuity of Audition*

The acuity of hearing was tested by two methods: the whisper method and the Seashore audiometer. In the whisper test (Andrews' method) the stimuli are special lists of number words prepared by Andrews.¹ The whisper was kept as uniform as possible by always using for it the residual air after a deep inspiration and expiration. Each ear was tested separately, a piece of cotton being placed in the external meatus of the ear not being tested. The child was seated with the ear in line with the examiner, eyes looking straight ahead, and told to "Say just what I say." It is sometimes necessary to explain very fully what is desired; one child so persistently said a totally different number than the one spoken by the examiner that misunderstanding was suspected and it was discovered that she thought we were playing a kind of game in which the examiner thought of a number and then she thought of a number.

The percentage of successful repetitions for each ear was recorded. After the whole group had been tested, the mean performance for each ear was found and this was used as a norm with which each child's performance was compared. The child's score was computed in terms of per cent of these norms. If a child made no error his score was of course above the average, and therefore necessarily above 100 per cent. A perfect performance with the right ear equaled 108, the average for the group being 92. A perfect performance with the left ear equaled 109, the group average being 91. Only two very low scores were obtained: one was right ear 64 per cent, left ear 43 per cent; the other, right ear 76 per cent, left ear 77 per cent. The latter is an adenoid case; the former's source of trouble has not been ascertained. The findings are presented in Table I. It was found necessary to examine ears for wax before testing and to wash out many. Otherwise, the wax deposits acted as stoppers and reduced the hearing.

The acuity of hearing was tested with the Seashore audiometer. For testing these children the audiometer was wired in series with one dry cell, a rheostat being introduced to keep the voltage constant at 0.8 volts. The sound is conveyed to the children's ears by telephone receivers and each ear is tested separately. The sounds

are produced in descending order from loudest to softest and then in ascending order, and the child is told to say "Now" or to nod the head when he hears it. With our little children only the descending order was used, as the children found it hard to fixate their attention upon the sound and it was difficult to hold them for more than three readings with each ear. Unavoidable noises from the street and school rooms distracted them somewhat. Three readings were secured for each ear and these were averaged to obtain the score. The highest readings in absolute numbers are the lowest scores because the highest numbers represent the louder sounds. There are no norms for children with which to compare our findings except our group average obtained from 44 children, which is: right ear 25.3, left ear 24.8. The average adult hears down to 12. The scores are presented in Table I, and may be compared directly with these averages. With the right ear, the poorest score, 37, was that of child No. 2, with 108 in the whisper test, and the next lowest, 34.5, was that of child No. 32, who made 87 in the whisper test. The best scores, 14.3 and 18, were made by children No. 14 and No. 52; child No. 14 made 108 in the whisper test and child No. 52 was not tested. One boy failed entirely who made scores of 87, right ear, and 77, left ear, in the whisper test. This boy was, however, a peculiar child, made reticent by a speech defect, a boy who would not be apt to respond until he was thoroughly familiar with the environment and the examiner.

The children were also tested for pitch discrimination, by means of resonators and tuning forks, varying from 435 v. d. to 465 v. d. by the steps $\frac{1}{2}$, 1, 2, 3, 5, 8, 12, 17, 23, and 30 in terms of vibration difference. In regular procedure the standard fork is sounded, then another, and the subject is asked to state whether the last tone is higher or lower than the first. As children of five years as a rule do not know the meaning of high and low in relation to sound, they were asked to sing the sound they heard. The frequently occurring exaggerations of interval by the children, if in the right direction, were taken to mean that the children really appreciated the difference in pitch. The least difference in pitch that the child distinguished with certainty was recorded as the score. The variations in the findings are so great that the group norm is useless. The scores vary from

2 to 17 vibration differences, with 13 total failures. The individual scores are given in Table I. The singing ability of the children was also judged by listening to each sing any little song he happened to know. The examiner noticed that there were as many ways of singing a song as there were children to sing it, and that the little ones had individual variations to which they clung. He also noticed that many of them had difficulty in changing from one tone to another when the difference was a half or whole step, or in some cases when the difference was a greater step.

4. Dental Examination

The dental examinations were made in a special room to which the children were brought one or two at a time. The examination charts were filled out at the dentist's dictation. The tabulated records are given in Table I. They show in 43 children 220 carious teeth, 15 abscesses and 5 cases of malocclusion. The teeth of 36 children needed cleaning by a dentist. Probably as a result of a school health crusade in progress at the time, 31 children had toothbrushes. Only one child had had a tooth filled, though the number of carious teeth, as previously mentioned, was 220. Apparently these conditions are due to the deplorable belief found among parents and even among some dentists that the condition of the first teeth does not matter because they will soon come out. The remedy would seem to be a school dental clinic.

To sum up the physical situation, every child in the group is in need of physical help and all but one in need of medical attention for more than one condition. Eight defects were found in each of two children, seven in each of five, six in each of eight, five in each of seven, four in each of five, three in each of nine, and two in each of six children. These children were not, however, from the poorest class of society, but lived in comfortable homes and had as much physical care as the children of the average working man receive. The appended type study sketches indicate the character of their environment. In spite of this, they were handicapped by the defects and malnutrition noted and were in poor physical condition for meeting the strains of school work.

III. ANTHROPOMETRIC MEASUREMENTS

“If in the future a scientific pedagogy is destined to rise, it will devote itself to the education of men already rendered physically better through the agency of the applied positive sciences, among which pedagogical anthropology holds first place.” So writes Montessori in the introduction to her *Pedagogical Anthropology*. In it she not only brings together an immense amount of anthropological data, but clearly points out that the school is the field in which anthropology may step beyond the limits of pure speculation and diagnosis and actually contribute toward the practical work of bringing school children up to the ideals of bodily form set by itself.

Physical anthropology concerns itself with gathering data on bodily form. Anthropology as applied to education concerns itself with gathering data on the developmental stages of form and variations of these. In process of the work it discovers variations from the usual in an individual child's development and points the way for ameliorative treatment before the parts of the body become fixed and set in faulty fashion, too often accompanied by just as faulty organic functioning. Thus pedagogical anthropology adds to the research function of anthropology a practical application which will be far-reaching in its effect upon the well-being of the present generation.

For a concrete illustration, if we find a child is too narrow chested and we know that with such a chest the lungs cannot develop or function as they should, that chest measurement is taken as a basis for special training and exercise which may, if it is begun in time, lead to the development of the chest and the saving of the child from tuberculosis.

Special stress is laid by anthropometrists upon the relation of various measurements to one another. For example, the ratio between sitting height and the height known as index of stature, is considered by many to give more information concerning bodily power and strength than either absolute measurement. For example, Montessori holds that the essential height is the sitting height because this measurement includes the trunk in which the vital organs are situated. According to her, the greater the size of the trunk in proportion to the height, the more room there is

TABLE II (1)

Child Number	Sex	Age	Birth Month	Height in Cm.	Sitting Height in Cm.	Index of Stature	Weight in Kgm.	Weight-Height Index	Chest Circumference	Vital Index	Chest, anteroposterior diam.	Chest, transverse diam.	Chest Index	Arm Span	Span-Height Index	Head, Greatest Length in Cm.	Head, Greatest Breadth in Cm.	Head, Aural Height in Cm.	Head, Circumference	Cephalic Index	Head, Capacity
1	B	5	5'13	102	62.5	61.27	18.5	.181	54	52.94	12	17.3	69.31	105.5	103.4	17.3	14.5	12.9	50.75	83.8	1269
2	G	5	3'14	111	64	57.65	23.1	.208	59	53.15	13.4	16.7	80.23	107.5	98.7	18.4	13.7	12	51.5	74.4	1206
3	G	5	11'13	110.5	61.5	55.65	21.5	.194	54.5	49.32	12	13	92.3	106	95.9	17.3	14.4	11.1	57	83.5	1132
4	G	5	4'13	116	61.5	53.01	19.4	.167	52	44.82	12.3	16.8	73.21	115	99.1	18.5	13.6	12.6	52	73.5	1248
5	G	5	4'13	115.5	61.5	53.22	19.4	.167	55	47.61	12	16.5	72.72	115	98.7	17.8	13.8	12.7	51	77.5	1285
6	B	5	3'13	114	60.25	52.85	19.0	.167	54	47.36	13	17	76.47	111.2	97.5	16.8	13.4	12	50	79.7	1115
7	B	5	2'14	101	53.7	53.16	14.7	.146	55	54.45	13.5	15.1	89.40	98	97.0	17.1	13.2	13.3	49	77.1	1201
8	B	6		118.5	67.5	56.9	22.6	.190	54	45.56	13.4	17.5	76.57	116	98.7	17.5	13.5	12.3	50	77.1	1173
9	G	5	4'13	109.5	62.5	57.07	21.7	.197	56.5	51.59	13.8	17.3	79.76	108	98.6	17.6	14.4	12.2	50.5	81.8	1226
10	B	6	11'12	114	61	53.5	20.3	.178	57	50	12.6	17.6	71.59	109.5	96.0	17.4	14.2	11.9	52	81.6	1183
11	G	5	6'13	105	66	53.3	17.3	.165	54	51.42	12.1	15.7	77.07	101	96.1	17.3	13.2	11	49.5	76.3	1059
12	G	5	5'13	111.5	60.9	54.61	18.5	.165	54	48.43	13.5	17.7	76.27	106	95.0	16.4	13.4	12.6	48.5	81.7	1135
13	B	6	10'12	116	64.6	55.51	23.1	.199	59.5	51.29	13.6	23.6	57.62	118	101.7	18.7	14.1	12.4	54	75.4	1277
14	G	6		107.5	61.6	53.7	17.7	.164	53	49.3	11.3	18.3	61.74	106	98.6	17.2	13.4	11.4	49.5	77.9	1093
15	G	6	12'12	107.3	56	52.09	16.3	.152	53	49.4	12.7	14.5	87.58	105	98.7	16.6	13.4	12.6	49	80.7	1144
16	G	5														16.3	12.5			76.6	
17	G	5	'13	100	54	54	15.7	.157	50.5	50.5	12.3	16.8	73.21	198	98	17.3	14.7	12.2	52	84.9	1230
18	G	5	5'13	108.5	60.8	56.03	18.1	.166	52.5	48.38	14.3	16.3	87.73	106	97.6	16.1	14	11.8	48	86.3	1103
19	G	5	10'13	101.3	55	54.29	15.8	.156	50	49.35	12.3	17.3	71.09	95	93.7	17.3	13.8	11.8	50.5	79.7	1147
20	G	5	2'14	106.5	59	53.39	16.7	.156	54.5	51.17	12.6	15.7	80.25	100	93.8	16.5	13.8	11.7	49	83.7	1104
21	B	6	10'12	106	61.6	58.11	16.3	.154	54.5	51.41	11.6	17.4	66.66	104.5	98.5	18.3	14.5	13.1	53.5	79.2	1338
22	B	5	3'13	116.5	65	55.69	20.8	.178	57.5	49.35	14	16.7	83.83	115	98.7	18.1	14.2	14.2	53	78.4	1389
23	B	5		102	55.7	54.60	16.0	.157								17.3	13			73.4	
24	G	6	3'13	110.5	56.4	51.04	19.4	.175	57	51.58	13.2	17.4	75.86	103	93.2	17.5	13.4	13.9	51.5	76.5	
25	G	5	2'14	104	54.3	52.21	14.4	.138	49	47.11	11.4	15.4	74.02	99.5	91.8	17.3	13.5	11.4	50	78	1276
26	G	5	2'14	115	64.5	56.08	20.3	.177	54	46.95	12	17.5	68.57	110	95.6	17.3	14.2	13.8	51	82	1314

TABLE II (2)

Child Number	Sex	Age	Birth Month	Height in Cm.	Sitting Height in Cm.	Index of Stature	Weight in Kgm.	Weight-Height Index	Chest Circumference	Vital Index	Chest, anteroposterior diam.	Chest, transverse diam.	Chest Index	Arm Span	Span-Height Index	Head, Greatest Length in Cm.	Head, Greatest Breadth in Cm.	Head, Aural Height in Cm.	Head, Circumference	Cephalic Index	Head, Capacity
27	B	5	12 '13	101	58	57.42	16.7	.165	52	51.48	12	16.8	71.42	99	98.0	20	15.1	12.2	53.5	75.5	1395
28	B	5	2 '14	109	62.3	57.15	19.0	.174	54.5	50	13	16.8	77.38	107.5	98.6	17.6	14.5	12.4	52	82.3	1247
29	G	5	12 '13	97.8	54.6	55.83	13.8	.141	52	53.17	11.7	15.7	74.52			16.4	13.8	11.8	49.5	84.1	1106
30	B	6	4 '13	118.5	62	52.57	23.5	.197	59.5	50.21	15.2	18.5	82.16	117	98.7	16.9	14.8	12.1	51	87.5	1208
31	G	5	10 '13	100	54.4	54.40	15.8	.158	56	56	14.5	15.8	91.77	96.5	96.5	16.5	13.7	11	49	83	1053
32	B	7	3 '12	107.3	58.4	54.52	20.6	.193	59	54.99	13.9	18.2	76.37	105.5	98.3	18.2	14.3	12.3	25.3	78.5	1157
33	G	5	7 '13	108.5	56.8	52.35	18.7	.172	60	55.29	12.7	14.8	85.81	102	94.8	16.4	13.6	11.6	49	82.9	1082
34	G	6	2 '13	107.5	63	58.6	17.2	.159	52	48.37	11.9	16.3	73.00	101	92.2	17.7	13.4	12.2	51	75.7	1169
35	B	5		109.5	60.5	55.25	16.7	.152	51.5	47.03	12.6	18	70.00	105	96.3	18	13.4	12.6	51	74.4	1211
36	G	6	2 '13	109	58.7	53.85	16.7	.153	52.5	48.08						16.9	14.2	12.3	51.5	84	1187
37	G																				
38	B	5	'13	103.5	58.9	56.9	15.4	.148	52.5	50.82	11	17.9	61.45	101	97.5	17.1	14.1	12.2	51	82.4	1184
39	G	5	4 '14	104.5			14.4	.137	49	46.88	11.4	14.6	78.08	100	95.6	17	13.8	12.9	50.5	81.1	1208
40	B	5		101	58.1	57.52	17.6	.174						99	98.0	17.7	13.6	12.5	51.5	76.8	1203
41	G	5		106.5	57.2	53.7	17.6	.164						108	101.4	17.3	13.8	12.2	50.5	79.7	1175
42	G	5		106	60.5	57.7	19.7	.186	56.5	53.3	13.5	16.5	81.81	106	100	17.5	14.1	12.7	51	80.5	1239
43	G	5	4 '14	100.5	57	56.71	17.6	.174	59.5	56.2	13.5	17.8	76.40	100	99.5	17.6	13.7	12.8	51	77.8	1225
44	G	5	4 '14	104	61	58.65	16.7	.161	56	53.84	14	17	82.35	103	99.3	18.1	14.2	13.1	52	78.4	1306
45	G	5	8 '14	108.5			17.6	.161	55.5	51.15	12.5	17	73.52			18.3	13.8	13.3		76.6	1304
46	B	4		104			18.1	.174													
47	G	6	4 '12	108.5	61.5	56.68	18.1	.166	55.5	51.15	12.5	16.5	75.75	114	105	17.4	13.3	12.6	50.5	76.4	1176
48	B	5	5 '14	108.5	60.5	55.76	16.0	.147	52.5	48.38	12.5	15.3	81.69	104	95.8	17.1	13.5	13.3		78.9	1221
49	B	5																			
50	B	5	10 '13	103	60.5	58.73	19.2	.186	57	55.33	14	15.5	90.32	101	98.0	16.8	13		51.5	77.3	
51	B	5	1 '14	112	56.5	50.44	18.2	.163						110.5	98.6						
52	B	6	1 '13	109.5	61.3	55.98	18.5	.168						109	99.5	18.2	12.9			70.8	

for these organs to develop and function and therefore the more vigorous is the physique.

There are numbers of established norms for adults and numbers of development norms, both of absolute measurements and of ratios between measurements. Montessori has gathered together many in her book, and many have been established by investigators in our own country—Baldwin, Hrdlicka, Boas, Smedley, De Busk, Wood and others. By the use of these norms educators can pick out the children who vary from the established standards and who require special physical care and corrective gymnastics for satisfactory development.

In our anthropological examination we made the measurements which are generally considered important and computed the significant ratios and indexes. We also inspected the child generally and noted any unusual conditions. The measurements taken and indexes computed were:

1. Height (standing, sitting, index of stature)
2. Weight (weight-height index)
3. Chest (circumference, vital index)
4. Span of arm (span-height index)
5. Head (maximal length, maximal width, aural height, circumference, cephalic index, capacity or volume).

1. Height

The height (without shoes) and sitting height of each child are recorded in Table II. The height may be compared with the Baldwin norms* which are:

<i>Boys</i>	<i>Girls</i>
5 yr. 41.8 in.	5 yr. 41.4 in.
5½ yr. 43.0 "	5½ yr. 42.2 "
6 yr. 45.4 "	6 yr. 44.3 "
7 yr. 47.8 "	7 yr. 46.8 "

The index of stature of each child recorded in Table II may be compared with the Montessori norms which are for five year-old children 59; for 6 year-old children 57; for 7 year-old children 56.

*Taken from Baldwin's *The Physical Growth of Children from Birth to Maturity*. Univ. of Iowa Studies in Child Welfare, Vol. 1, No. 1. In press.

2. Weight

The weight of each child recorded in Table II may be compared with the Baldwin norms which are:

<i>Boys</i>	<i>Girls</i>
5 yr. 37.6 lbs.	5 yr. 36.3 lbs.
5½ yr. 39.6 “	5½ yr. 38.1 “
6 yr. 45.2 “	6 yr. 42.6 “
7 yr. 50.6 “	7 yr. 48.0 “

Weight tells, however, very little about the size of the person, if we know nothing of his height. Eighty pounds is a good weight for a boy of 13 who measures 60 inches, but a poor weight for a boy of 13 who measures 63 inches. Considered in relation to each other, weight and height are indicative of the state of nutrition. Other things being equal, weight diminishes as malnutrition increases. This relation may conveniently be expressed by dividing the weight by the height to obtain the weight-height coefficient. In Table II is recorded this coefficient for each child. The amount of any child's deviation from the weight-height coefficient for his age can be obtained by comparison with the Baldwin norms, which are:

<i>Boys</i>	<i>Girls</i>
5 yr. .90	5 yr. .88
5½ yr. .92	5½ yr. .90
6 yr. .99	6 yr. .96
7 yr. 1.05	7 yr. 1.02

In order to secure the parents' interest in the children's condition, a meeting was called at which their attention was directed to the underweight and undernourishment discovered in the group. The Wood cards correlating ages, heights and weights were used as a convenient popular means for explaining to the parents the meaning of norms of development and were distributed in the hope that an attempt would be made in the homes to bring the children up to normal standard. By the Wood standards 30 of the 40 children are underweight for their age and height. Sixteen children are 10 or more per cent underweight. By Baldwin's Iowa norms, these children are relatively tall but underweight.

Insufficient food explains very few of these 30 cases; it explains two, possibly three, in all.

In examining the medical sheet for reasons other than food and housing, we find that children Nos. 4 and 5, each of whom lacked six pounds, both had adenoids, hypertrophied tonsils, enlarged glands, many carious teeth, flat foot and umbilical hernias. These little girls are twins. The mother takes good care of them and they have a comfortable home; but the parents, the father in particular, do not realize the importance of attending to such physical defects as are here summarized. The father objected to the examination by the physician. The children are bright mentally and would be good looking were they not forced by the condition of the pharynx to keep their mouths open most of the time. Child No. 6 also has a good home but we find that his vision is very poor and his teeth in bad condition. Child No. 7 is slightly deaf and has a number of carious teeth, but more important perhaps is the fact that the mother has been entirely unable to control the child and does not insist upon his eating the proper food. He eats what he chooses, when he chooses, and will eat nothing else. He is extremely nervous and over-active. More than all else this child needs discipline by one whose authority he would respect. Child No. 10 is a boy in a deplorable condition as a result of diseased tonsils and adenoids. He cannot breathe at all with closed mouth, there is a constant offensive discharge from the nose, the hearing is reduced in both ears and eight teeth are carious. Child No. 11 has enlarged glands, enlarged tonsils and very poor vision. Child 12 has adenoids, enlarged tonsils and cervical glands, defective vision, diminished hearing, heart murmur and rales. She has a good home, but is an only child, is uncontrolled and probably eats unwisely. Child No. 13 has enlarged glands, poor vision, heart murmur, scoliosis, lordosis, and needs circumcision. Child No. 14 has enlarged tonsils, carious teeth, defective vision and flat foot. Child No. 15 has defective vision, enlarged cervical glands, rales and heart murmur. This child very probably has insufficient food and poor home care. Child No. 18 has enlarged tonsils, adenoids and glands, and defective vision. Child No. 20 has defective vision. He is a very well cared for child from a well kept home. Child No. 21 has enlarged glands and adenoids. The home conditions are poor, and there is a possibil-

ity of insufficient nourishment. Child No. 22 has visual defects and heart murmur. The home is poor and ill-kept and there is a possibility of insufficient food. Child No. 23 has defective vision. Child No. 24 has but one defect, 12 carious teeth. The child is suffering much from toothache. The home is poor and badly kept. Child No. 26 has enlarged adenoids. The home is unusually good. Child No. 29 has enlarged adenoids and tonsils, is extremely nervous, but has, in general, been well cared for. Child No. 33 has enlarged adenoids, tonsils and glands, and flat foot, but is well cared for at home. Child No. 34 has enlarged tonsils, adenoids and glands, and carious teeth. Child No. 36 has enlarged tonsils and glands, adenoids, and defective vision. The home is good. Child No. 37 has carious teeth. No. 40 has carious teeth. No. 45 has enlarged glands and tonsils, and carious teeth. No. 47 has enlarged glands, defective vision, carious teeth and heart murmur. The home surroundings are poor. No. 48 has enlarged glands, carious teeth and defective vision. The family conditions show marked poverty. Nos. 51 and 52 have carious teeth; no medical examination was made. Thus every child who is underweight is shown to have one or more physical defects and in addition, 18 have a haemoglobin content under 80. Six of the underweight children were not given a haemoglobin test and five rated 80 or over.

3. Chest.

The relation between the circumference of the chest and the height furnishes another measure of the robustness of form. In a robust adult the chest circumference is close to one-half the height. At birth it is 8 to 10 cm. in excess of one-half the height, and at five about 4 or 5 cm. in excess of it (Montessori). The index, found by the formula $\frac{100 \times \text{Chest Circumference}}{\text{Height}}$ is called the Vital Index. In the adult it is 50, in the child of five it would normally be greater than 50. The vital index for each child in the group is recorded in Table II. Eighteen out of 43 children so measured have vital indices of less than 50, which means a decidedly small chest circumference; 22 have indices greater than 50, which is more nearly the expectation; and two have an index of 50, an adult proportion. One of these is a boy of 6 and one a boy of 5.

All but one of the children having a Vital Index of less than 50 are underweight.

The antero-posterior and transverse diameters of the chest (recorded in Table II) are significant not only in themselves but also in relation to each other. The ratio between them, the Chest Index, which is indicative of chest and lung development is calculated by the formula: $\frac{100 \times \text{Antero-posterior Diameter.}}{\text{Transverse Diameter}}$. At birth these diameters are nearly equal and the index varies from 90 to 100. The transverse diameter gradually increases over the antero-posterior until in adult life the average chest index is 75, with extremes of 65-85. The measures and indices for the group are given in Table II. They vary from 57.62 to 92.3 with an average of 76.77. The boy with the index of 57 is underweight and has scoliosis, heart murmur, and enlarged cervical glands. A girl with a chest index of 61 is also underweight and has enlarged cervical glands and tonsils, and lordosis. Another child with a chest index of 61 is much underweight and highly nervous. The other children all have chest indices within normal range.

4. Span of Arms.

The span of arms or distance between the tips of the middle fingers on each hand when the arms are stretched out horizontally is recorded in Table II. The span is interesting principally in the ratio to the height called the span-height index and calculated by the formula: $\frac{100 \times \text{Span of Arms.}}{\text{Height}}$. The indices found (Table II) vary from 91 to 105, the average being 97. The span was in most cases slightly less than the height, exceeding the height in the case of only four children. There was one index of exactly 100 and 22 indices of 98 and 99.

5. Head.

The exact significance of head measurements and of indices is still disputed ground in the field of anthropometry. Some investigators claim to have found that the circumference varies with the nutritional condition of the child. Others have found head size to be correlated with the intelligence of children. A third school, that of Karl Pearson, finds little relation between any head measurement and intellectual ability.

Head measurements must be considered in relation to the size of the body as a whole, the racial type of the individual and other vari-

ables. Apart from the question of their correlation with intelligence, it is of interest to study head measurements merely from the point of view of physical development. Accordingly, the maximal length and width of the head and the aural height were measured by means of a standard cephalometer and the circumference taken with an anthropometric tape. A tracing of the shape of each head was also taken, a band of soft lead being molded around the head, then placed upon a sheet of paper and its inner surface used as guide for a pencil tracing. This method is of course, not exact enough to secure slight anomalies of shape, but it does give, very satisfactorily for general inspection, the proportions and gross anomalies. The head conformitor, often used, which does record the exact shape of the head, is so heavy and so much like an instrument of torture that it is impossible to use it with such little children without frightening them. These measurements are recorded in Table II.

The circumference alone which is frequently given as indicative of head size, is rather misleading since it does not indicate to any degree the height of the vault of the cranium, which increases greatly as brain and head develop. The circumference has value when considered in relation to volume, but it is not the best index of volume. It varies in our children between 48 and 57 cm. In a collation of the findings of various investigators we find limits of 46 to 54.1 cm. for the ages five to seven inclusive. Our maximal circumference is that of a five year old girl, the child of Russian Jews. She has a head capacity of 1132 cu. cm. by the Lee formula discussed later in the *Study*, and is a brachycephalic. This is the only circumference which differs from the usual measurements.

The three diameters, breadth, length and aural height are given in Table II. The ratio between length and breadth, obtained by the formula $\frac{100 \times \text{Breadth}}{\text{Length}}$, is called the Cephalic Index. This index is, in children, more significant than the circumference because after the first two years of life the proportions of the cranium remain practically the same, while the circumference increases. This makes age norms necessary to judge of a circumference and unnecessary to judge of a cephalic index.

The cephalic index varies normally between 70 and 90. Within these limits there are three shapes of head: dolichocephalic, or the long head; brachycephalic, or the broad head; and the meso-

cephalic, or the intermediate form. If the cephalic index falls between 75.1 and 79.9 the shape is mesocephalic; if it falls between 70 and 75, the shape is dolichocephalic; if it falls between 80 and 86.9, the shape is brachycephalic; and if it is greater than 86.9, the shape is hyperbrachycephalic. These are figures limiting the types which are usually found in this country, but there are several other standards. An index less than 70 or greater than 90 indicates abnormality of some sort. The type of head is considered a racial characteristic. The people of Asia as a rule are brachycephalic, those of Africa dolichocephalic, those of Europe and America range from dolichocephalic through mesocephalic to the extreme brachycephalic. The index is used as a basis for classification of human races and as a key to determine from which races a given people has originated.

The cephalic indices of our children, computed by the regular formula are presented in Table II. Among our children we found all three types of head. Five were dolichocephalic: children No. 2, 4, 36, 23 and 52; twenty were brachycephalic: children No. 1, 3, 9, 10, 12, 15, 17, 18, 20, 26, 28, 29, 30, 31, 33, 34, 37, 38, 39, 42; twenty-four were mesocephalic: children No. 5, 6, 7, 8, 11, 13, 14, 16, 19, 21, 22, 24, 25, 27, 32, 35, 40, 41, 43, 44, 45, 48, 50, and 54.

All of these children were born in the United States, but among the parents and grandparents we find the following nationalities represented: English, Irish, Swedish, Canadian, German, Dutch, Norwegian, Russian, Bohemian, Moravian and Danish. Among the dolichocephalic we find English and German ancestry; among the mesocephalics, English, Scotch, Irish, Canadian, German, Swedish, Norwegian, and Russian ancestry; and among the brachycephalics, English, Irish, German, Dutch, Swedish, Norwegian, Bohemian, Russian and Danish. All of the Bohemians are brachycephalic, one a hyper-brachycephalic; all but one of the Russians are brachycephalic, and his index is 79.7; the Norwegians, Danes and Dutch are represented only in the brachycephalic group; the the hyperbrachycephalic boy is extremely tall, large in all his proportions, very fair and blue eyed; his parents are Bohemians.

The cranial capacity of these children was computed by a formula of Alice Lee used by Dr. S. D. Porteus in a study of normal Australians and of feebleminded children in Vineland, N. J. The

formula is: (length — 11mm.) (breadth — 1mm.) (height — 11 mm.) $\times .000337 + 406$ cu. cm. Table II shows the cranial capacity of each child in the group.

Cranial capacity increases with age up to a maximum which is set at different ages of adult life by different investigators. Like cephalic index it is dependent upon stature and race.

Porteus using the Lee formula and measuring normal children of seven, eight and nine years, gives limits of volume as 1160 and 1480 cu. cm., with a median of 1282. The limits of head volume with our group measured by the same methods, are 1053, Child No. 31, and 1395, Child No. 27, with a median of 1187. These two children whose head measurements are the extremes of our group are both five years old; their index of stature varies directly with head capacity (54.40-57.42) as also does their head circumference (49-53.5). The general intelligence of the child with minimum measurements is, if anything, a little more highly developed than that of the child with maximal measurements.

Just as the results of the medical examination are of greater diagnostic value when considered in relation to each other, so also are the anthropometric findings. In judging a chest development we learn more by referring to Index of Stature, Vital Index, and Chest Index than by referring to any one of these indices. By consulting Table II, we find that Child No. 7 has an Index Stature of 53.16, a Vital Index of 54.45 and a Chest Index of 89.40. We know by the first that his trunk is short in proportion to his legs, by the second, that the circumference of his chest is in good proportion to his height, and by the third that the chest is too round, retaining its infantile proportions. By referring to the medical record, Table I, we find that he has prominent scapulae and scoliosis. In this case the Vital Index alone gives no idea of the lack of development of the transverse diameter which the Chest Index and the note on the protruding scapulae supply. We naturally refer next to the lung record and find it clear. In judging of head development we learn more by referring to the Head Capacity, Cephalic Index and Circumference together than by referring to any one of them. Let us examine these measurements for Child No. 3. The head capacity is 1132 cu. cm. This is below the medium degree of brachycephaly. The circumference is 57, the largest circumference found in our class and several centi-

meters beyond standard norms for the age of the child. The circumference alone indicates a large head, the capacity contradicts this, the contrast between the two indicates a low vault of the cranium, and this we find is actually the case, the aural height being 11.1 cm., while the minimum height in all our children is 11 cm.

On account of the modifying effects of the various anthropometric data upon each other our findings are of much more practical use in forming a judgment of an individual child than they are in forming a judgment of the class as a group. The class averages for the various anthropometric measurements are therefore not presented.

IV. SPEECH EXAMINATION

The speech of 42 children in the group was tested, the following points being considered:

I. Posture of child in relation to speech.

II. Respiration

a. Breath control

b. Chest expansion

Upper and lower chest inflated and deflated

c. Type of breathing: Superior costal, inferior costal.

III. Voice

a. Quality of tone: Resonant, unresonant

b. Volume of tone: Loud, soft

c. Inflection: Range of tone, monotony

IV. Speech

a. Type of speech difficulty

b. Specific record of consonants and consonant combinations giving difficulty

c. Vowels slighted or non-resonant

The materials used were:

I. Words containing all consonants in initial, middle and final position

II. Words containing principal vowel sounds

III. Selections for testing reading and articulation (School readers and story books or pictures)

IV. Franz speech testing material Test No. 75141

V. Set of alphabet blocks

VI. Lewis Phonetic Cards (1915)

VII. Tongue depressors and tongue applicators.

It was found impossible on the basis of the examination results to divide the class into two groups, one of which contained

children with perfect speech, and the other of which contained children with defective speech. In speech, as in other abilities, the transition is so gradual from normal performance to defective performance that it does not permit of an absolute dividing line. The division which seems most practical is that into two groups of children, one containing children who had no speech difficulties which could not be eradicated by regular classroom training, and one containing children who required special training for speech defects of a more serious nature. Of the 42 children examined, 32 fall into the first group, requiring no special form of speech training. Ten, however, need expert training for the correction of speech inaccuracies and negligencies, five of these ten being classified as defective speech cases. In one of the five a very marked and persistent infantile stammer exists. This child has great difficulty in making himself understood by anyone except a little brother of five years who not only understands him, but talks in the same way while conversing with him, though using normal articulation when talking to other people. The only time that this little boy, Child No. 1 of our series, talks freely, rapidly, and with ease and apparent enjoyment, is when he is playing with this little brother and has to make no effort to conform to the usual method of speech.

The specific speech difficulties found, with number of cases of each type, were:

Negligent lisping	6 cases
Organic lisping	2 "
Infantile speech	3 "
Monotony of tone	8 "
Faulty respiration	4 "
Nasality	4 "
Unresonant voice	7 "
Inaudibility	2 "
Negligent speech habits.....	4 "
Faulty articulation	7 "
Poor posture (affecting speech).....	2 "
Total number of speech difficulties encountered	49
Number of different types of speech disturbance	11

In spite of the fact that in this one class of kindergarten children there are ten children who need instruction in speech from a person specially trained in the technique of speech correction,

the school system provided no teacher for this special type of work. If we assume that the need is as great in all first grades of the city as it is in this one under inspection, the failure to provide such instruction is a very serious omission. In the case of Child No. 1 it may result in absolute failure to progress in the grades.

V. MENTAL EXAMINATIONS

There are two facts about human beings which have an all-important bearing on educational practice. The first of these is a very great similarity of mental ability, the second is an equally great diversity of mental ability.

The first fact, the great similarity, has made it possible to develop intelligence scales, like the Binet tests, which in effect assert that average human beings all have a certain degree and kind of mental ability at 5 years of age, a certain other degree and kind of mental ability at 6, 7, 8, 9, 10, and 12 years of age, etc., as the age increases.

The second fact, the great individual diversity of mental ability, compels us to realize that among a group of, let us say, 20 children, each having the same level of mental development, we may have twenty different types of children, each one having his possibilities of greatest development and greatest success in a different direction from all the others. One child of the intelligence level of 10 years may have very good color perception and a vivid imagination and very poor application and reasoning ability; another child of the same intelligence level may be color blind and lacking in all invention and yet have well-developed capacity for sustained attention and good reasoning ability. Various combinations of abilities, disabilities, strengths and weaknesses, make a class of 20 children of about equal general intelligence a group of intensely individual characters, each presenting a different problem.

In our public schools, after the feeble-minded,—those permanently subnormal in general intelligence,—have been discovered and removed from the general classes, the problems of the teacher are not greatly simplified by a knowledge of each child's intelligence level. It is essential for the teacher to know much more than this; she must know for each child which mental abilities are most apt to yield the greatest rewards from cultivation and which

mental abilities it is vain to try to develop. She must know why this boy of good general intelligence does not learn to read, or does not learn to subtract. In order to obtain this knowledge, a mental analysis is necessary which will reveal the individual's mental strengths and weaknesses.

Many psychologists make such analyses, but a method of analysis combined with a method of presenting results equal in precision and clearness to the method used in presenting the results of an examination for general intelligence has never been developed. Rossolimo¹⁷ used a method of expressing the results of such analysis which he called the psychological profile. His method contains a suggestion of one which perhaps combines the elements of clearness and precision for which we are looking. Rossolimo used a series of tests ranging over the various mental abilities, scored the results so obtained and presented them in graphic form. A perfect score for the test given for any mental ability was 10; if an individual made a score of 10 in visual memory, 7 in dispersed attention, 3 in color perception, etc., the graph would show a depression at the point representing dispersed attention and a still greater depression at the point representing color perception. The peaks in the graph would represent strengths of abilities, the depressions in the graphs, weaknesses. A graph consisting of a straight line would represent, according to Rossolimo, perfectly balanced mental abilities.

As a matter of fact, though it is possible to produce a graph showing just what Rossolimo attempted to show by his psychological profile, Rossolimo's graphs fail to do so. They fail because Rossolimo failed to equate the score values of his numerous tests. Each group of tests was scored by the same method, ten tests were given for each mental ability, 1 point accredited for each success, 10 being the perfect score. There is nothing in this procedure to suggest that a score of 10 in any one ability tested represents exactly the same strength of that ability as a score of 10 represents for each of the other abilities. It is easy to realize that a series of tests devised for one mental ability might demand a lesser degree of development of that ability in order to secure a perfect score than a series of tests devised for a second ability might demand of that second ability in order to secure a perfect score.

Claparède⁵ recognized the inherent beauty of the profile method; he also realized that Rossolimo's failure to equate the scores for the several abilities completely destroyed the value of the profile as a record of the comparative strengths and weaknesses of an individual's mental ability. He, accordingly, suggested a very simple modification, or rather an amplification, of Rossolimo's profile which makes of it a true psychological profile, showing quite accurately the strengths and weaknesses in an individual's mental makeup.

Claparède proposed using a series of analytic tests, Rossolimo's or others, with a homogeneous group of individuals, let us say, 15 year old boys, arranging the results of each test in rank order and compiling from the rank orders of the various tests a percentile table for each to show what score in each test is made by the 0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 percentile of the group. The actual scores made by any one percentile, say the 50 percentile, for the various tests might be quite different, but they would have the same percentile value for the group. One test might have a 90 percentile score of 40, another test a 90 percentile score of 80. The actual score for the latter test would be twice that for the first test, but its value as a performance compared with the performance on the other tests of the group would be exactly the same as that of the lower score for the first test. From the complete percentile table computed from the results of a series of tests given to a homogeneous group, we can learn just what scores the lowest tenth and the successively higher tenths of the group attained. We can compare with these findings an individual's score and learn at once the relation of his performance to that of the entire group, and can compare his score not only with the median score for the group, but with the score of each tenth of the group from lowest to highest.

If an individual made scores equal to the 90 percentile in all of the tests given, he would be uniformly strong mentally for the particular group of individuals (15 year old boys, 12 year old girls, congenitally blind adults, etc.) to which he belongs. If he made scores equal to the 50 percentile, he would be uniformly mediocre mentally. If he made scores equal to the 90 percentile in one test, the 70 percentile in another, and the 30 percentile in another, he would be of uneven ability, strong in some directions, weak in

others, and the differences disclosed would be a valuable guide for the wise teacher. The individual graph, or psychological profile, as Rossolimo calls it, according to this plan, will be made up from the percentile values of the scores, not from the actual scores, and the peaks and the depressions in this graph will actually represent strengths and weaknesses of achievement.

Rossolimo's profile, supplemented by Claparède's idea of basing the profile values on percentile values, has opened the way for clear, precise presentation of the results of a mental analysis, a presentation in a graph which will truly represent the psychological profile. We have adopted this method and have treated the results of a long series of analytic tests by the plan of Claparède, presenting the psychological profile for typical children in the group. (Charts III, IV, V, VI.)

The mental examination of each child included:

1. *General Intelligence Tests.* An examination and rating of the general intelligence by two methods:

The Binet Simon Intelligence Scale, 1911 revision³

The Stanford Revision of the Binet Simon Intelligence Scale²²

2. *Analytic Tests.* A mental analysis made by the use of tests for:

(a) Perception:

- | | | |
|----------|------------|--------------|
| (1) Grey | (4) Green | (7) Form |
| (2) Red | (5) Yellow | (8) Position |
| (3) Blue | (6) Length | (9) Weight |

These are all tests of the perception of slight differences, the performance in each instance consisting of a comparison and matching.

(b) Immediate Memory for:

- | | | |
|----------------|--------------|---------------|
| (10) Words | (13) Objects | (15) Position |
| (11) Sentences | (14) Forms | (16) Pictures |
| (12) Color | | |

(c) Attention

- (17) Visual span
- (18) Auditory span
- (19) Simple attention
- (20) Discriminative attention
- (21) Simple attention

- (22) Discriminative attention
- (d) Active imagination
 - (23) Heilbronner
 - (24) Healy-Fernald Puzzle A
 - (25) Healy-Fernald Puzzle B
- (e) Reasoning
 - (26) Judgment
- (f) Psycho-motor ability
 - (27) Steadiness I, right hand
 - (28) Steadiness I, left hand
 - (29) Steadiness II, right hand
 - (30) Target, right hand
 - (31) Target, left hand
 - (32) Spirometer
 - (33) Dynamometer, right hand
 - (34) Dynamometer, left hand
- (g) Learning ability (involving perception, attention, memory and motor habit formation)
 - (35) Healy-Fernald Puzzle A
 - (36) Healy-Fernald Puzzle B
 - (37) Wiring
 - (38) String games
- (h) Suggestibility
 - (39) Judgment of length
 - (40) Judgment of weight
 - (41) Hallucination of smell
 - (42) Hallucination of taste
 - (43) Automatism, taps
 - (44) Automatism, eye—hand

3. *Complex Performance Tests.*

- | | |
|------------------------|------------------------|
| (45) Maxfield cube | (48) Knox-Pintner cube |
| (46) Seguin formboard | (49) Porteus maze |
| (47) Line reproduction | |

We thought it of interest to include in our mental examination several tests, the performance of which involves too many mental abilities to permit of their being included in the analytic series. They are all valuable in diagnosis, just because they do involve a complex mental activity and bring out characteristic temperamental reactions and fatigue reactions which the analytic tests

fail to do. These tests are five in number: the Maxfield cube test, the Seguin²¹ formboard test, the line reproduction test, the Knox-Pintner¹³ cube test, and the Porteus¹⁴ maze test.

1. *General Intelligence Tests.*

Forty-five children were tested by the Binet Intelligence Scale³ and also by the Stanford Revision of the Binet Scale.²² In Table III are presented the scores in relation to the chronological age. The Symbol A indicates that the test age and chronological age are identical; numbers preceded by + indicate the number of years the test age exceeds the chronological age, and numbers preceded by — indicate the number of years the test age falls short of the chronological age. The same method of scoring is used for the Knox-Pintner cube test, and for the Porteus maze test, for both of which age norms have been established. It cannot be followed for the Healy A as the method of presentation is not comparable.

In the Binet-Simon 1911 series, 14 children scored at age, 18 children scored one year above age, 11 children scored two years above age, and two children scored one year below age. The mode thus shifts from the chronological age to one year higher, with 16 children attaining lower and 11 children attaining higher scores than the mode.

By the Stanford revision, 25 children scored at age, 16 children scored above, and four children below age. The mode is at age, but the distribution favors the excess age, scoring 16 to four. The Binet 1911 scale shows a better distribution around the mode, but the mode is one year in advance of the chronological age.

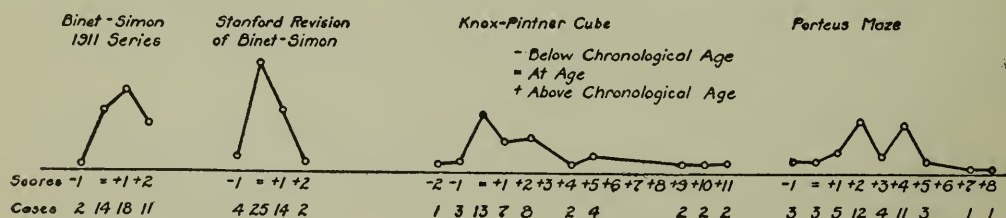


Chart I Distribution of Scores in Mental Age Tests

It is gratifying to note that only four children in this class grade by either scale below chronological age, and that no child is more than one year retarded. There is a possibility that one child in the class has subnormal intelligence, but he is handicapped by so many physical defects that their correction may result in greater progress than now seems probable.

2. *Analytic Tests.*

The scores obtained by each child for each of the 44 analytic tests are presented in Table III. The Mean and Mean Variation and the Probable Error and Probable Error of Mean are represented for each test. One test of imagination, two of attention, the Winch reasoning test, two learning tests (substitution method), and steadiness test II, left hand, were discarded as the result of the mathematical treatment of the results, the P. E. for each of these tests being greater than half the mean, and therefore invalidating the results. The individual scores for each of the 44 remaining tests were then arranged in rank order from the lowest to the highest. The lowest score for each test was used as the 0 score for the percentile table, the highest for the 100 percentile score; the lowest tenth of the series was considered in the 0 percentile; the lowest score above this lowest tenth of scores was used as the 10 percentile; the lowest score above the lowest two-tenths of scores for the 20 percentile, etc. From this percentile table of scores for each test (Table IV) the individual percentile ratings were obtained by translating individual absolute scores (Table III) into terms of percentiles. For instance, Child No. 3 made in test 15 a score of 28.56 (Table III). By looking at Table IV, one finds this is the score made by the 30 percentile of the group. Thirty, then, is the percentile rating for Child No. 3 in this test. The graphs or psychological profiles are plotted from the percentile ratings. Each profile represents one child's performance in the series of tests whose names are given at the top of the graph. A dot opposite the name of each test indicates the child's percentile rating in the test. The lower the dot on the graph the lower is this percentile rating and the poorer his performance. Typical profiles are shown for a number of children for whom descriptive sketches are also given in Section VI of this *Study*.

Our percentile values are computed from the results obtained from a small group of children. For a few of the tests the number was as low as 23, though for most of the tests it reached 39, 40 or more. Though the group was quite homogeneous the percentile values from such a small number could in no way be considered as norms. The percentiles were computed in the absence of norms for such young children, largely in order to make comparable the work of different children on the series of tests, and to realize fully the

possibilities of the profile method for mental analysis. Such psychological profiles as are here presented if based on accurate norms, cannot fail to reveal the mental strengths and weaknesses of the individuals they represent, and a series of such profiles will bring into prominence the differences in mental quality of the individuals represented. The value of such information to one choosing individuals from a group for a certain kind of employment or profession is very apparent.

a. *Perception*

Tests 1, 2, 3, 4, 5—Perception of Color and Brightness. The first group of tests was designed to measure the ability to perceive slight differences in color and brightness. The colors used were red, blue, green, and yellow. For each of these, five strips—tints 1 and 2, standard, and shades 1 and 2, Bradley Colors—were mounted, in the order named, on gray cards, and for each of these, five smaller gray cards were prepared on each of which was mounted a duplicate of one of the five colors on the large card. Similar materials were prepared, using five shades of Hering grays.

The tests were conducted as follows: the card containing the five reds was placed on the table before the child and the five smaller cards were placed nearer him. The experimenter pointed to the lightest tint, saying, "Find the red just like this." After the child had found it, the experimenter pointed to the next tint, giving the same directions and so proceeded until the five small cards had been placed. This procedure was repeated with blue, yellow, green and gray. It was found by preliminary experiments that more than five colors made the situation so complex that it ceased to be a true perception test for children of five years. The tests also ceased to be tests of perception if the child was asked to arrange the small cards as were the colors on the large card. Binet³ called attention to a similar situation in his test which requires the arrangement of five boxes in order of weight, pointing out that the power to hold in mind the idea of serial order is involved as well as perception of slight difference in weight. The latter ability Binet placed at four years and the more complex one at ten years. For each of these tests, 20 was credited for each successful matching, the perfect score being 100. The group percentile score for the 39 children tested was high, 100 being the 40 percentile score for green and yellow and the

TABLE III (1)

Child Number	Sex	Age	Binet Age	1	2	3	4	5	6	7	8	9	10	11
				Gray	Red	Blue	Green	Yellow	Length	Form	Position	Weight	Words	Sentences
1	B	5	5	20	40	40	20	40	0	0	30	22.2	66.64	50.00
2	G	5	5+	60	66	40	100	100	16.66	66.64	50	66.6	66.64	62.50
3	G	5	6+	100	60	100	100	60	100.00	33.32	40	88.8	66.64	62.50
4	G	5	7	100	100	60	100	100	16.66	0	60	55.5	66.64	62.50
5	G	5	7+	60	100	60	100	60	33.32	0	40	44.4	66.64	75.00
6	B	5	7+	60	100	100	100	60	16.66	66.64	80	11.1	83.30	75.00
7	B	5	6	100	60	60	60	60			40	55.5	66.64	62.50
8	B	6	6+	60	60	100	100	100	33.32	66.64	80	55.5	83.30	87.50
9	G	5	6+	20	60	40	100	60	33.32	66.64	50	44.4	66.64	100.00
10	B	6	5+	60	40	60	100	60	16.66	0	40	100.0	66.64	100.00
11	G	5	6+	40	100	60	100	100	33.32	33.32	100	11.1	83.30	
12	G	5	6+	100	60	40	40	100	100.00	16.66	80	77.7	83.30	100.00
13	B	6	7+	20	60	20	100	100	66.64	0	80	22.2	83.30	50.00
14	G	6	6+	100	40	100	100	60	16.66	33.32	50	55.5	66.64	87.50
15	G	6	7+	40	100	40	60	60	100.00	33.32	40	22.2	83.30	75.00
16	G	5	6+	60	100	60	100	60	100.00	66.64			49.98	
17	G	5	7+	60	60	100	100	60	100.00	33.32	100	55.5	83.30	87.50
18	G	5	7	60	100	60	100	100	49.98	0	30	44.4	83.30	87.50
19	G	5	6+	60	100	60	60	60	100.00	49.98				
20	G	5	6+	100	60	100	100	100	49.98	0	30	44.4	49.98	62.50
21	B	6	6+	100	40	40	100	40	66.64	0	80	55.5	83.30	87.50
22	B	5	7+	60	100	100	100	100	16.66	16.66	50	44.4	100.00	75.00
23	B	5	7	100	20	100	100	60	100.00	16.66			83.30	100.00
24	G	6	6+	60	60	60	100	100	100.00	33.32	60	66.6	66.64	62.50
25	G	5	6+	40	100	100	100	100	49.98	49.98	20	44.4	100.00	100.00
26	G	5	5+	100	60	60	60	100	100.00	33.32	80	11.1	66.64	37.50
27	B	5	6+	40	40	40	100	100	100.00	33.32	100	44.4	83.30	100.00
28	B	5	5+	40	100	60	100	100	100.00	33.32	100	33.3	66.64	62.50
29	G	5	6											
30	B	6	7	100	20	40	100	100	66.64	16.66	40	55.5	100.00	100.00
31	G	5	6+										66.64	
32	B	7	6+	100	100	100	100	100	16.66	16.66	40	44.4	66.64	87.50
33	G	5	6+	60	60	100	60	60	66.64	49.98	50	44.4	83.30	87.50
34	G	6	6+	60	60	100	60	100	66.64	100.00	100	66.6	83.30	87.50
35	B	5	5+						49.98	0	60	77.7	66.64	
36	G	6	6+	60	40	60	60	60	66.64	33.32	50	55.5	66.64	100.00
37	G													
38	B	5	5+	40	100	40	40	100	33.32	66.64	50	77.7	66.64	50.00
39	G	5	7											100.00
40	B	5												
41	G	5												
42	G	5	5+	60	40	100	60	100	49.98	33.32	50	44.4	66.64	50.00
43	G	5	7+	60	100	40	60	100	33.32	16.66	50		83.30	87.50
44	G	5	7	60	60	60	100	60	100.00	33.32	100	66.6	83.30	75.00
45	G	5												
46	B	4												
47	G	6	6+										66.64	62.50
48	B	5	6+										83.30	50.00
49	B	5												
50	B	5	6+	100	60	60	100	60	100.00	66.64	80	55.5	83.30	100.00
51	B	5												
52	B	6	8+	100	60	100	100	100	66.64	0	100	44.4	100.00	75.00
No of cases				39	39	39	39	39	39	39	39	37	42	38
Failure														
Average				67.1	68.7	68.9	86.1	80.5	60.2	31.1	61.0	50	75.76	76.9
M. V.				21.8	22.2	22.2	19.1	19.9	26.7	12.4	18.7	15.7	10.71	15.8
P. E.				18.7	18.7	18.7	16.2	16.8	22.6	10.5	15.8	13.3	9.07	13.4
P. E. M.				2.9	3.0	3.0	2.5	2.7	3.6	1.6	2.61	2.1	1.39	2.18

TABLE III (2)

	12	13	14	15	16	17	18	19	20	20	21	22	23
Child Number	Colors	Objects	Forms	Position	Picture	Visual Span	Auditory Span	Attention, Simple	Attention, Discriminative	Diff. in Efficiency Indices	Attention, Simple	Attention, Discriminative	Heilbronner
1	0	28.56	20	14.28	50	0	0	2.50	1.53	.97	.72	.72	22
2	33.33	27.15	40	14.28	30	80	80	3.03	.79	2.24	.74	.72	26
3	100.00	28.56	40	28.56	80	80	40	5.00	1.80	3.20	.71	.75	18
4	0	14.28	40	57.12	40	100	60	5.00	2.50	2.50	—		15
5	33.33	28.56	20	42.84	100	80	60	2.27	1.63	.65			23
6	100.00	42.84	40	14.28	40	80	20	2.00	1.00	1.00	.64	.47	34
7					40		60	2.17	.81	1.36	.57	.52	29
8	100.00	42.84	40	42.84	40	60	60	4.34	1.50	2.84	.77	.67	32
9	100.00	28.56	40	57.12	80	60	60	4.00	1.28	2.72	1.00	.96	37
10	0	28.56	40	28.56	80	60	0	2.30	1.26	1.04	.48	.68	34
11	100.00	42.84	80	57.12	30	60	0	4.17	1.40	2.77	.66	.65	22
12	33.33	14.28	20	14.28	50	0	0	3.39	.50	2.89	.64	.72	29
13	66.66	28.56	40	28.56	40	0	0	2.50	1.10	1.40	.92	1.15	34
14	66.66	57.12	60	57.12	40	80	60	2.38	.95	1.43	.90	.91	34
15	100.00	42.84	40	42.84	50								33
16					40	0		1.81	1.38	.48	.83	.70	24
17	100.00	57.12	40	100.00	80	80	40	4.00	1.63	2.37	1.04	.85	36
18	33.33	42.84	40	28.56	40	60	100	5.00	1.50	3.50	.73	.50	22
19	66.66	57.12	40	42.84		60	40	2.50	2.50	0	.69	.55	31
20	66.66	57.12	40	28.56	70	0	0	5.00	1.20	3.80	.91	.68	35
21	66.66	42.84	20	57.12	30	80	40	5.00	2.20	2.80	.90	.83	38
22	33.33	74.40	60	75.68	60	60	80	3.39	1.20	2.19	.70	.71	28
23	100.00	42.84	60	28.56	100	80	60	3.33	1.69	1.64	.62	.48	24
24	100.00	42.84	80	28.56	80	80	40	3.03	1.20	1.83	.76	.74	27
25	66.66	100.00	60	42.84	100	80	60	4.17	1.30	2.87	.89	.67	34
26	66.66	28.56	60	28.56		0	0	2.38	1.60	.78	.79	.64	26
27	33.33	28.56	40	28.56	100	0	0	4.75	1.48	3.27	.72	.50	25
28	66.66	42.84	40	57.12	40	60	60	1.33	.83	.50	.83	.47	26
29					40								28
30	66.66	28.56	60	14.28	40	60	60	7.69	3.26	4.43	.99	.76	28
31	66.66							1.70	1.28	.42	.55	.55	
32	66.66	42.84	20	42.84	50	60	40	5.00	2.32	2.68	.55	.21	19
33	66.66	28.56	20	42.84	40	80	80	2.43	.97	1.46	.73	.51	29
34	66.66	57.12	40	14.28	40	60	60	3.70	1.25	2.45	.82	.58	29
35	66.66	28.56	20	0	40	0	0	3.81	2.00	1.81	.71	.36	36
36	100.00	42.84	40	42.84	60	60	60	2.94	1.81	1.13	.61	.57	17
37													
38	33.33	42.84	20	57.12	40	0	40	4.00	1.53	2.47	.30	.56	36
39					90	20							32
40													
41													
42	66.66	57.12	60	57.12	30	20	60	3.33	1.81	1.52	.75	.63	26
43	66.66	42.84	20	0	30	60	20	2.85	1.07	1.78	.63	.79	13
44	66.66	57.12	20	42.84	50	60	60	2.94	1.53	1.41	1.25	.38	20
45													
46													
47													
48						20	40						
49													
50	66.66	28.56	20	57.12	50	60	40	2.00	1.08	.92	.54	.22	24
51													
52	66.66	42.84	100	85.68	90	80	40	5.00	2.27	2.73	1.04	.50	29
No.	36	37	37	37	37	28	28	40	40	40	38	38	42
F.													
A.	65.7	42.45	41.60	40.91	55.5	68.57	52.1	3.44	1.50	2.0	.78	.62	28.2
M.V.	19.25	11.3	14.25	17.73	19.6	12	16.1	1.03	.38	.9	.14	.14	4.9
P.E.	16.26	9.55	12.04	14.99	16.6	10.1	13.3	.87	.32	.7	.11	.11	4.18
PEM	2.67	1.57	1.98	2.46	6.3	1.9	2.5	.12	.05	.1	.01	.01	.63

TABLE III (3)

	24	25	26	27	28	29	30	31	32	33	34	35	36
Child Number	Healy-A	Healy-B	Judgment	Steadiness 1 R	Steadiness 1 L	Steadiness 2 R	Target R	Target L	Spirometer	Dynamometer R	Dynamometer L	Healy-A	Healy-B
1	F	F	0	1	1	0	1	1	902	7.5	8.5	383.0	0
2	212	F	60	2	1	3.0	1	1	656	9	7	769.0	40
3	F	F	20	1	1	8.0	2	2	656	9	8	312.0	54
4	125	211	80	2	1	14.0	3	2	720	7	7		111
5	F	85	70	1	1	15.0	3	3	902	7	7	0	204
6	F	F	50	1	1	11.5	2	2	1066	10.5	9	222.0	222
7	F	F		2	1	8.0	3	0	492	7	10	0	66
8	75	145	30	3	2	11.0	4	3	1148	11	12	666.0	232
9	F	F	40	1	1	7.5	2	1	984	8	7	222.0	175
10	170	F	50	0	0	0	3	1	492	6	5	500.0	60
11	F	F	80	1	1	7.0	2	1	902	8	6	250.0	66
12	F	F	60	1	0	2.0			720	11	9	147.0	55
13	F	280	80	3	3	9.5	3	3	1312	13	12	0	178
14	F	F	60	1	1	3.0	3	2	738	9	8	178.0	66
15	100	60		2		15.0	2		401	8		500.0	178
16	80	90		1	1	7.0	3	3	820	10	9	119.0	166
17	F	115	50	1	1	6.0	3	2	656	6	6	500.0	217
18	F	142	20	1	2	7.0	2	3	720	6	5	666.0	161
19	F	F	50				3	2	401	5	5	250.0	4
20	56	F	80	2	2	9.5	3	2	656	6	5	83.3	74
21	123	110	50	1	1	10.0	2	3	720	7	6	125.0	83
22	F	56	70	1	0	7.0	1	1	1168	9.5	9.5	175.0	200
23	35	120	50	0	0	3.0	4	4				79.0	66
24	68	F	90	1	2	13.0	3	1	984	8	10	125.0	74
25	F	F	30	2	2	7.0	3	2	656	3	4	0	250
26	40	F		2	0	9.0	3	2	738	5	6	166.0	58
27	95	F	0	0	1	1.0	1	1	460	6	7	133.0	55
28	130	F	70	1	1	8.0	2	1	984	10	9	256.0	51
29	F			1	1	0	2	1	246	5	5	0	
30	120	F	90	1	1	9.5	2	2	574	12	7	357.0	200
31													
32	19	250	100	0	0	0	0	0	738	12	10	526.0	125
33	173	438	60	0	0	5.0	1	1	733	7	9	277.0	62
34	F	81	40	2	1	7.0	2	2	720	11	10	333.0	0
35	F	F	80	0	0	6.0	3	3	656	11	9	0	222
36	F	F	40	2	1	8.0	3	2	902	6	6	333.0	222
37													
38	F	F	60	2	2	0	2	1	246	6	5	0	69
39													
40				0	0	0	2	2					
41													
42	107	F	50	0	0	0	2	2	984	6	5	196.0	70
43	F	F	70	1	2	2.0	2	2	574	8	5	250.0	0
44	F	64	40	1	1	8.0	2	2	492	5	5	100.0	0
45													
46													
47				1	1	6.0	1	0					
48													
49				1	1	5.5	2	2					
50	F	109	60	1	0	5.0	2	1	656	6	8	166.0	58
51													
52	171	395	70	3	3	8.0	3	3	1394	10	8	500.0	200
No.	18	17	36	42	41	42	43	43	40	40	40	40	40
F.	23	23										7	5
A.	101	164	54.1	1.19	1	6.47	2.21	1.74	760	7.8	7.33	307.09	125
M.V.	41.9	33	20.2	.64	.56	3.29	.69	.77	204.01	1.9	1.41	152.82	65
P.E.	35.4	28	17.1	.53	.47	2.48	.58	.65	172.44	1.6	1.19	129.18	55
PEM.	8.35	7	2.8	.08	.07	.42	.08	.09	27.22	.25	.19	22.51	9.3

TABLE III (4)

Child Number	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
	Wiring	String Games	Judgment-Length	Judgment-Weight	Hallucination-Smell	Hallucination-Taste	Automatism-Taps	Automatism-Eye Hand	Maxfield Cube	Form Board	Line Reproduction	Binet	Stanford	Knox-Pinter Cube	Porteus
1	50	0	0	F	F	+	S	N	50.00	51	27.5	A	-1	+1	-1
2	50	60	32	10	0	0	S	S	83.30	185	20.0	A	A	+5	+2
3	50	80	0	10	+	+	S	S	50.00	178	47.5	+1	+1	+2	+1
4	100	60	0	10	0	0	S	N	100.00	69	65.0	+2	+1	+2	+2
5	100	60	32	10	0	+	S	N	100.00	277	85.0	+2	+1	+9	A
6	50	0	32	10	0	+	S	S	33.32	256	55.0	+2	+1	+2	+4
7	50								33.32		20.0	+1	A	A	+2
8	50	60	25	0	+	+	S	S	83.30	333	55.0	A	A	-1	+5
9	100	80	32	10	+	+	S	S	66.64	172	70.0	+1	A	+1	A
10	0	20	23	10	0	0	S	S	16.66	119	17.5	-1	-1	-1	+1
11	50	20	32	10	+	0	S	S	16.66	76	42.5	+1	A	A	+2
12	0	40	32	10	+	0	S	S	66.64	83	25.0	+1	A	A	+2
13	50	40	32	10	0	0	S	N	66.64	200	70.0	+1	A	-1	+4
14	100	40	32	10	+	+	S	S	33.32	78	70.0	A	A	A	+4
15	50						S	S	83.30	238	87.5	A	A	A	+2
16		80							66.64	61		+1	A	+5	+4
17	100	80	32	10	0	0	S	N	83.30	222	90.0	+2	+2	+9	+5
18	100	20	18	10	+	0	S	N	300.00	151	55.0	+2	+1	+1	+4
19	50		32	10	+	+	S	S	33.32	51	60.0	+1	A	+5	+3
20	100	40	32	F	+	+	S	S	83.30	192	45.0	+1	A	+1	+4
21	100	40	32	10	+	0	S	S	83.30	274	85.0	A	A	+4	+7
22	100	60	32	10	0	0	S	S	100.00	263	60.0	+2	+2	+1	+8
23		20	32	10	+	0	S	S	100.00	270		+2	+1	+10	+4
24	100	20	32	10	+	0	S	N	83.30	333	37.5	A	A	A	+3
25	0	20	32	10	0	0	S	S	66.64	217	35.0	A	A	+5	+1
26	100	40	32	10	+	+	S	S	33.32	71	25.0	+1	+1	A	+1
27	50	40	32	10	+	0	S	N	33.32	227	40.0	+1	A	+1	+2
28	0	20	0	F	+	0	S	N	66.64	98	55.0	A	A	A	+5
29	0								16.66		12.5	+1	A	A	A
30	100	40	32	10	0	0	S	N	66.64	87	70.0	+1	A	+10	+3
31	50								83.30	175		+1	+1		
32	100	80	32	10	+	0	S	N	50.00	80	12.5	-1	-1	-2	-1
33	100	60	32	10	0	+	S	N	83.30	166	27.5	+1	+1	+2	+2
34	50	20	32	10	+	+	S	S	83.30	69	85.0	A	A	A	+3
35	100	20	32	10	+	+	S	N	16.66		15.0	A	A	A	-1
36	100	20	32	10	+	+	S	S	100.00	142	65.0	A	-1	A	+2
37															
38	100	40	32	10	+	+	S	S	100.00	66	27.5	A	A	+2	+4
39			17	10					66.64			+2	+1	+2	+2
40	50														
41															
42	100	20	32	10	0	0	S	N	33.32	75	50.0	A	A	+2	+2
43	50	0	32	10	0	0	S	N	33.32	156	30.0	+2	+1	A	+2
44	100	40	28	10	0	0	S	N	100.00	45	60.0	+2	+1	+11	+1
45															
46															
47	100								100.00			+1	+1	+11	+4
48												+1	A	+1	-
49	0														
50	100	40	32	10	+	0	S	N	66.64	175	30.0	+1	A	+2	+4
51									100.00						
52	100	80	32	10	0	0	S	N	100.00	200	70.0	+2	+1	+4	+4
No.	38	36	38	38					45	42	38				
F.	4	3	3	3						3					
A.	70	41.8	29						67.02	158	48.7				
M.V.	22	18.7	4.5						23.35	70.9	19.8				
P.E.	19.3	15.36	3.8						19.74	59.93	16.7				
PEM.	2.8	2.67	.64						2.94	9.6	2.6				

TABLE IV

		Percentiles																								
		Gray																								
		Red																								
		Blue																								
		Green																								
		Yellow																								
		Lines																								
		Form																								
		Position																								
		Weight																								
		Words																								
		Sentences																								
		Color																								
		Objects																								
		Forms																								
		Position																								
		Pictures																								
		Visual Span																								
		Auditory Span																								
		Attention Simple																								
		Attention Discrim.																								
		Attention Simple																								
		Attention Discrim.																								
		Heilbronner																								
		Healy-A																								

70 percentile score for red, blue, and gray. In no case was there a complete failure though the 0 percentile was 20 for red, blue, green, and gray. The individual scores and percentile scores are presented in Tables III and IV.

Test No. 6. Perception of Differences in Length. The method of perception of small differences was again used. A gray card $2\frac{1}{2}$ by $4\frac{1}{2}$ inches had drawn on it six vertical lines $\frac{3}{8}$ of an inch apart, the shortest 1 inch long and the others increasing regularly in length by $\frac{1}{8}$ of an inch. The child was given six small gray cards $1\frac{1}{2}$ inches wide, on each of which was drawn a line similar to one of the six lines on the large card. The procedure was exactly that used in the color perception test. The examiner pointed to the shortest line on the card containing the six lines and then to the other lines in order, saying each time, "Find the line just like this."

A credit of 16.6 was given for each line matched correctly, 100 constituting a perfect score. Thirty-nine children were again tested, the 70 percentile group making a perfect score, the 50 percentile a score of 66.44 and the 0 percentile 0. The average score was 60.2, M. V. 26.7, P. E. 22.6. The group did not succeed so well here as with the color perception tests. (Tables III, IV).

Test No. 7. Perception of Differences in Form. Again the method of perception of small differences was used. A series of six gray figures was mounted on black cardboard. The first figure was a $1\frac{1}{2}$ inch square. The base lines and heights of all figures were $1\frac{1}{2}$ inches but the upper side diminished by $\frac{1}{16}$ of an inch in each succeeding figure, both ends of the line being shortened by $\frac{1}{32}$ of an inch. Similar figures were drawn on small cards, one figure on each card. These were given to the child and he was asked, as in the preceding tests, to "find one like this" as the examiner pointed successively to the mounted figures on the large card.

Credit of 16.6 was given for each correct matching. Thirty-nine children were tested, and the perfect score of 100 was reached only by the 100 percentile of the group; the 50 percentile scored 33.32 and the 20 percentile score was 0. The average score was 31.19, M. V. 12.4, P. E. 10.5. The children found greater difficulties in this test than in any of the preceding tests. (Tables III, IV,).

Test No. 8. Perception of Position. The materials were again five lines. These were two inches in length, drawn above a base line on a strip of gray cardboard $12\frac{1}{2}$ inches long. The first line was hori-

zontal and parallel with the base line; the second was tilted up at the left end; the third, fourth and fifth lines were increasingly tilted. Five lines similarly placed were drawn on smaller cards. As in the other perception tests, the child was asked to find a line like each in turn as it was pointed out. The test was repeated with lines in the vertical direction.

A credit of 10 for each matching was given. Thirty-nine children were tested, the 90 percentile making a perfect score; the 50 percentile, 50, and the 0 percentile 20. The average score was 61, M. V. 18.7, P. E. 15.8. (Tables III, IV).

Test No. 9 Perception of Weight. This was quite a difficult performance for the little ones. Tin pill boxes were used which were weighted with shot. One, weighing ten grams, was used as a standard weight and nine others compared with it; four of these were heavier, increasing by amounts of two grams each; four were lighter, decreasing by amounts of two grams each; and one weighed the same as the standard. The child was given the standard weight in one hand and then handed another and asked, "Is this heavier, lighter or just the same?" When the opinion was given, the child was allowed to place one box on one pan of a scale and one on the other pan to see whether his judgment was correct. Without this procedure it was hard to hold the children's attention to the test; with it, they greatly enjoyed the game. There were nine judgments, 11.1 being the credit for each. No one child attained a perfect score and only one of the 37 children tested reached the 100 percentile, 88.8. The 50 percentile score was 55.5 and the 0 percentile score 11.1. The average score was 50, M. V. 15. 7, P. E. 13.3. (Tables III, IV,).

b. *Memory*

The tests for memory were six in number. They tested the immediate memory span for number words, for words connected in sentence form, for colors, for familiar objects, for geometric forms, for position, and for pictured objects. It was necessary to confine the word memory tests to the oral field as the children had not yet learned to read.

Test No. 10. Memory for Words. The span for number words was tested as follows. The examiner said to the child, "I am going to say some words and after I finish I want you to say just what I have said." Then she pronounced two numbers, and if the child succeed-

ed in repeating them, she tried a series of three, then of four and so on, increasing each time by one until the child made an error in repeating. He was then given two more chances to repeat a list of equal length and if he succeeded, a list longer by one word was used. When the child failed three successive times to repeat lists of equal length, his span was placed at the longest list which he had succeeded in repeating. As lists containing six numbers were repeated by four children in the group and as a span for five numbers is shown by Binet³ to be an eight year performance and a span of three, a four year performance, six was considered a perfect span for our children and a score of 100 was assigned to it, 16.66 being given for each number repeated correctly in the longest series repeated perfectly. Forty-two children were tested. The 100 percentile made a perfect score; the 60, 70, 80 and 90 percentile made a score of 83.3 (span 5); the 0 percentile score was 49.9 (span 3) the 50 percentile score was 66.6 (span 4). The average score was 75.7 M. V. 10.7, P. E. 9. (Tables III, IV).

Test No. 11. Memory for Sentences. For measuring the memory span for words combined in sentence form the group of sentences prepared by Binet was used. The highest achievement of the group was shared by eight children, who repeated sentences containing sixteen words. A score of 100 was assigned to this performance and 6.25 given for each word in the longest sentence repeated. Thirty-eight children were tested, the 80, 90 and 100 percentiles making a perfect score; the 0 percentile score was 37.5 and the 50 percentile score was 75. The average score for the group was 76.9; M. V. 15.8; P. E. 13.4 (Tables III, IV).

Test No. 12. Color Memory. For testing color memory, the materials used were twelve white cards, 3 by 5 inches, in the center of each of which a 1 inch square of colored paper was pasted, and a card 5 by 6 inches, on which twelve similar squares were pasted. Two of the small cards were shown to the child, who was told to look at them well because he would be asked to pick out these colors on a card containing these and other colors. The small cards were removed and the large one substituted and the child asked to point out the colors which he had just seen. If he failed, he was given two more chances with two different colors each time. If he succeeded in one of the three trials, the procedure was repeated with three and with four colors until the child failed to recognize three series each con-

taining the same number of colors. His span was taken to be the largest number of colors he remembered in one of three trials.

Thirty-six children were tested and three proved to be the largest span reached. One hundred was assigned as the perfect score for 3 and 33.3 was accredited for each color remembered in the longest series correctly matched. The 80, 90, and 100 percentiles attained a score of 100; the 0 percentile failed entirely; the 50 percentile made a score of 16.66 (span 2). The average was 65.7; M. V. 19.25; P. E. 16.26. (Tables III, IV).

Test No. 13. Memory for Familiar Objects. For testing memory for familiar objects, the following objects were used: book, twine, pencil, envelope, key, black-board eraser, box, pocket-book, nickel, ring, bag, and handkerchief. The objects were all placed in a large pasteboard box. Groups of the objects were placed on the lid of the box, shown to the child, then replaced in the box while he waited in another part of the room. He was then asked to pick those he had seen from the complete group. The procedure followed was identical with that used for the color memory test. The child was given three chances with each group containing a given number of objects until he failed in three successive trials with the given number of objects, one success in any group constituting success with that group.

Thirty-seven children were tested. Seven objects being the greatest number remembered by any one child, a score of 100 was assigned to the span of 7 and 14.28 was accredited for each object remembered in the maximal span attained. The perfect score was made only by the 100 percentile, the 80 and 90 percentile scores being 57.12 (span 4), the 0 percentile score being 14.28 (span 1) and the 50 percentile score being 42.84 (span 3). The average was 42.4, M. V. 11.3, P. E. 9.5. (Tables III, IV).

Test No. 14. Memory for Form. Materials used in testing memory for form were chosen from the Bradley box of forms. They consisted of a sphere, spheroid, cube, ovoid, two cylinders, two pyramids, circle, cone, square and prism. The procedure was exactly the same as that used in testing memory for objects. Thirty-seven children were tested; five was the greatest number of forms remembered; 100 was therefore assigned as the score for a span of 5 forms, and 20 for each form remembered in the maximal score attained. The perfect score was made by only one child. The 80 and 90 percentiles made scores of 60, (span 4), the 0 percentles a score of 20 (span 1) and

the 50 percentile a score of 40 (span 2). The average was 41.6, M. V. 14.25, P. E. 12.

Test No. 15. Memory for Position. The test for memory of position is one used by Rossolimo.¹⁷ Ten white cards, 3 inches square, were used. These were ruled in nine 1 inch squares. On card 1 a black dot was placed in the center of the lower right square; on card 2, a black dot was placed in the center of the middle left square; on card 3, two black dots were placed, one in center of middle right and one in center of lower left squares; on card 4, black dots were placed in center of upper center, middle right, and lower left squares; on card 5, black dots were placed in center of upper left, upper center, and lower right squares; on card 6, black dots were placed in center of upper left, upper right and lower left squares; on card 7, black dots were placed in center of middle left and middle center, upper right and lower right squares; on card 8, dots were placed in center of middle left, lower left, upper center and middle right squares; on card 9, dots were placed in upper left, middle center, middle right, lower right and lower center squares; on card 10, dots were placed in center of upper left, middle left, upper center, lower center and lower right squares. Squares of paper ruled exactly like the cards but not containing the dots were given each child. Card 1 was shown to him and he was told to remember where the dot was because he would be asked to draw it on one of the papers. The card was removed and the child drew the dot on the ruled sheet. This procedure was repeated until all cards were shown.

Thirty-seven children were tested. No children succeeded in remembering the positions of the dots on cards 8, 9, and 10. Therefore the score of 100 was given for success with the first 7 cards and 14.28 assigned for each card successfully reproduced. Only one child made a perfect score; the 70, 80, and 90 percentile scores were 57.1 (four cards) the 0 percentile was 0 and the 50 percentile was 42.8 (three cards). The average score for the group was 40.9, M. V. 17.7, P. E. 14.9. (Tables III, IV.)

Test No. 16. Memory for Pictured Objects. Material for testing memory for pictured objects was found ready-made in a game consisting of 72 little colored pictures of familiar objects such as a horse, cat, kite, doll, table, etc. and 6 cards, on which are duplicated the smaller pictures, 12 small ones on each large card. The proced-

ure used is the same as that described in tests for color, object and form memory, the small pictures being shown in groups of two, four, etc. and the child being required to point to the same pictures on a card which was exposed as soon as the small pictures were removed. Three successive failures in a group consisting of a given number of pictures constituted a failure and the span was recorded as the largest number of objects recognized. Forty children were tested; four children recognized each object in a group of ten. This was the best record and a score of 100 was assigned to it, 10 being given for each picture in the largest group recognized. The 100 percentile made a perfect score (span 10), the 0 percentile, a score of 30 (span 3), the 50 percentile a score of 40 (span 4). The average score for the group was 55.5, M. V. 19.6 and P. E. 16.6.

c. *Attention*

The tests selected to examine attention were nine in number: a test of visual span, a test of auditory span, two designed to test simple attention, two to test discriminative attention, two to test disparate attention, and one to test the scope of attention. It was found necessary to omit the last three tests mentioned from our group results, as the probable errors for all three tests were too large.

Tests No. 17 and 18. Visual and Auditory Span. The test for visual span was very simple. Parallel lines were drawn on cards, two on one card, three on another, four, five and six on still others. A card was exposed for an instant; it was then removed and the child asked how many lines there were on the card. This was continued until his maximal span was ascertained.

The auditory span was judged in a similar way, a series of taps with a pencil on the desk being the stimulus. Twenty-eight children took these tests. Five was the largest group of lines and of taps perceived by any child. A score of 100 was assigned to this performance, and 20 given for each number in the highest span attained. For both tests the 100 percentile score is 100 and the 50 percentile score is 60; the 0 score for visual span is 20 and for auditory span 0. The average for visual span is 68.57, M. V. 12, P. E. 10.1; the average for auditory span is 52.1, M. V. 16.1, P. E. 13.3.

Tests No. 19, 20, 21 and 22. Simple and Discriminative Attention. Two tests for discriminative attention were used; the first was a cancellation test. For it the Woodworth and Wells²⁴ substitution

test sheet, geometric forms, was used, the child being told to cross out all the squares. This sheet was used rather than the cancellation sheets made up of letters or numbers because the figures are larger and the eye strain, which is considerable in the letter and number tests, is eliminated.

As two elements of performance, accuracy and rapidity, enter into the discrimination test, the score is expressed in terms of an index of efficiency obtained by use of the formula

$$\frac{\frac{C - W}{C + O} \times 100}{T}$$

C representing the number of figures crossed, W the number of figures wrongly crossed, O the number of figures omitted, and T the time consumed in performance.

As for many children of five years the act of crossing out, apart from any purpose in so doing, claims much attention and care, and as at this age the degree of skill in crossing out varies much from child to child, the efficiency index for the discriminative attention test depends not only upon the degree of discriminative attention attained, but also upon manual dexterity. On this account the efficiency index attained by one child is hardly comparable with that attained by another, as one does not know the relative values of the manual dexterity element for the two children. In order to reach a truer expression of ability in discriminative attention, the examiner introduced another test which calls for the same manual skill, but for no discrimination. Twenty squares (there are twenty squares on the Woodworth and Wells sheet) were drawn on paper and the child asked to cross them out, the time being recorded. This test was given in every case before the discrimination test. The index of efficiency was obtained by the formula given above. As errors and omissions were few, the index was in most cases

$$\frac{\frac{20}{20} \times 100}{T}$$

There were several exceptions, however. A comparison of the efficiency index attained by any child in the cross-out test with the index attained by the same child in the discrimination test will show a lowering of the efficiency index, due to the added element of discrimination, and this difference in efficiency indices is a truer expression of efficiency in discrimination than the efficiency index for

that test, because it expresses the loss of value in efficiency index due to the added task of discrimination. The greater the loss in the efficiency index, the less is the efficiency of discriminative attention. In the case of one child only was there no difference between the two indices. She crossed out all the squares in both the tests and in just the same time, 40 seconds. The practice in crossing out in the first test may have compensated for discrimination time in the second test. In Table III the indices for both tests and the differences in the two indices are presented. In the individual profiles only the percentile rank for the index of the simple cross-out test and the percentile rank of the difference between the two indices are represented. Forty children were tested. The 100 percentile score for the cross-out was 7.69, the 50 percentile score was 3.33, and the 0 percentile score 1.33. The average was 3.44, M. V. 1.03, P. E. 0.87. The 100 percentile scores for the discrimination differences was 0, the 50 percentile 1.83, the 0 percentile 6.40. The average was 2.0, M. V. 0.9, P. E. 0.7.

Two other comparison tests in simple and discriminative attention were taken from Rossolimo.¹⁷ These were perforation tests. In a white card, 8½ by 4 inches, were punched 102 holes in a regular pattern. A very heavy piece of felt was placed on the table before the child. It was covered by a piece of paper and on top of the paper was placed a perforated card. The child was given a stiletto and told to punch a hole in the paper through each hole in the card. The procedure was illustrated for the child and he was shown that the pattern on the card was reproduced on the paper. His performance was timed. This test was followed by another, similar to this but with a greater number of holes, and the child was asked to punch only those holes which were encircled by a line drawn with ink. (There were actually 102 of these). The first test is designed to test simple attention, the second to test discriminative attention. A slight change was made in Rossolimo's test for the sake of uniformity. Rossolimo simply uses the reverse side of card one for test two, encircling 62 of the holes on the reverse side. It was thought better for the sake of comparison of results to require the child to punch the same number of holes, and therefore a second card was prepared, bearing a design, in which the unit figure of the first card was used a greater number of times.

Efficiency indices were calculated for both of these perforation

tests by the use of the formula used in treating the cancellation tests. Thirty-eight children were tested. In the simple perforation test the 100 percentile score was 1.3, the 0 percentile score 0.48, and the 50 percentile score 0.73. The average was 0.78, M. V. 0.14, P. E. 0.11. In the discrimination test the 100 percentile was 1.15, the 0 percentile score 0.21, the 50 percentile 0.64. The average was 0.62, M. V. 0.14, P. E. 0.11. The difference in the efficiency indices for these two tests were also calculated, and it was found that the 80 percentile lost nothing in efficiency index through the added complication of discrimination, and that the 90 and 100 percentile gained in efficiency. In no case did the difference exceed 0.87. These results indicate that the increase in ease of punching due to punching 102 holes increases the efficiency in the second test enough in many cases entirely, and in all cases partially, to compensate for the added complication of the task. The differences in the efficiency indices, therefore, are not so good an indication of the power of discriminative attention as are the indices of the discrimination test itself, and these are therefore given in both tables and profiles. (Tables III, IV.)

Disparate Attention. The two tests of Rossolimo¹⁷, used to study disparate attention, were found unsuitable for such young subjects.

(d) *Imagination.* For testing imagination one test was used to study the passive form, the Heilbronner ¹¹ unfinished picture test, and four tests to study the active, creative form. These were (1) the invention of sentences containing two different words; (2) the arrangement of a picture story, both of which proved unsuccessful for the purposes of this experiment, and (3) (4), the Healy Fernald Puzzles A and B.

Test No. 23. Heilbronner. The material for this test consists of 13 series of cards. On all but one card of each series are drawings, in varying degrees of incompleteness, of some familiar object, and on one card is the completed representation. The cards of each series are shown to the child in the order of increasing completeness until the object is correctly named. The objects pictured are: windmill and telephone (seven drawings each); clock, graphophone, butterfly, fireplace and thermometer (six drawings each); pencil (five drawings); book, broom, and lamp (four drawings each), pen (three drawings).

The fireplace and thermometer series were discarded as the com-

pleted drawing of the fireplace scarcely suggested one, and a thermometer was not familiar to the group. Each of the 11 remaining series was scored according to the number of pictures in each. A child who named on the first card the object pictured in seven suggestions, received a score of 7; a child who failed to name the same object until the sixth card, received a score of 2, losing one for each drawing on which he failed to recognize the object. If he failed on all seven cards he lost seven points. As two series contained seven drawings each, four series six drawings each, one series five drawings, three series four drawings each, and one series three drawings, the maximum score was 58.

Forty-two children were tested, making an average of 28.2, M. V. 4.9, P. E. 4.18. The 100 percentile score is 42, the 50 percentile score 28, and the 0 percentile 13. (Tables III, IV).

Test No. 24, Healy-Fernald Puzzle A. The Healy-Fernald Puzzle A¹⁰ is a well-known test of the formboard type. Five small rectangles of varying size must be fitted into a rectangular space. The test is scored by recording the number of seconds used by the child in solving the puzzle. Ten minutes was the limit of time allowed. Forty-one children were tested; 23 failed to succeed in ten minutes. The 18 who succeeded made an average time of 101 seconds, M. V. 41.9, P. E. 35.4. The 100 percentile score was 19, the 50 percentile 107, and the 0 percentile 212. (Table III, IV.)

Test No. 25, Healy-Fernald Puzzle B. The Healy-Fernald Puzzle B¹⁰ is another well-known formboard puzzle. This was also scored by recording the time consumed in solving, and ten minutes was the limit allowed. Forty children were tested, and again 23 failed to solve the puzzle in the ten minute limit. For the 17 who succeeded, the average time was 164 seconds, M. V. 32., P. E. 28. The 100 percentile score was 56, the 50 percentile 115, and the 0 percentile 438. The achievement in Puzzle A is thus quite superior to the achievement in Puzzle B. (Tables III, IV).

(e) *Reasoning.* Three tests of reasoning power were tried, only one proving valuable for such young children. In the first test the child was given a simple figure and told to trace it with his pencil, never lifting the pencil, or never drawing over the line twice. This was done successfully by only seven of the 36 children tested, and the test was excluded from the group report. The second test was

the Winch²³ reasoning test, which also proved too difficult for such young children.

Test No. 26, Reasoning. The third reasoning test²³ was better adapted to the children. It called for a judgment of the validity of reasoning. The little ones are better able to judge whether someone's else reason is a good one, than they are to initiate a reason of their own. The test is given in the following manner: "Some little children were asked, 'Why does not grass grow in winter?' I am going to tell you just what ten of them said and I want you to tell me each time whether the answer is a good one, whether it really tells why grass does not grow in winter, or whether it does not. One little girl said, 'Because it is winter now.' Is that a good reason?'" etc. The other reasons given were: (2) Christmas is in winter, (3) Because it is too cold for it, (4) Because the ground is frozen, (5) We have fire in winter, (6) It needs hot sun, (7) Grass is green, (8) Winter is cold, (9) Grass grows in summer, (10) We go to school in winter. A score of 10 was given for each correct answer. Thirty-six children were tested; the average score was 54.1, M. V. 20.2, P. E. 17.1. The 100 percentile score was 100, the 50 percentile 60, and the 0 percentile 0. (Tables III, IV.)

i. *Psycho-Motor Ability*

We have included in our series a group of tests, the successful performance of which depends upon physical and muscular fitness and also upon a central motor control. These are neither purely physical nor purely mental tests. It is only by tests of this character that we can reach an expression of that very essential mental activity—volitional control of movement. Five tests were used; first, steadiness of right and left hand while effort is made to hold them motionless; second, steadiness of right and left hand while in motion; third, accuracy of aim with right and left hand; fourth, vital capacity; fifth, right and left hand grip.

Tests Nos. 27 and 28. Steadiness 1. The apparatus used for testing steadiness of hand while an attempt is made to hold it motionless is furnished by C. H. Stoelting Company, Chicago, and is called a steadiness tester. It consists of a metal plate set at an angle of 45°, and a metal stylus with a wooden handle. The plate is pierced by nine holes. The diameters of the holes successively diminish, measuring 32, 20, 16, 13, 11, 10, 9, 8 and 7 sixty-fourths of an inch

respectively. For the test, this apparatus was wired in circuit with a bell which rang when the metal plate was touched with the stylus. It was placed on a table in front of the arm the child was to use and the child was given the stylus and asked to hold it in the middle of the largest hole without touching the sides. Every time a movement of the hand brought the stylus in contact with the sides of the hole the bell rang. The examiner performed the test for each child to show him how to do it. The child was credited with the smallest hole in which he succeeded in holding the stylus without contact during the fifteen seconds. The holes were numbered according to size, 1, 2, 3, 4, 5 and so on. Each hole was used first by the right hand, then by the left.

The average score for the right hand was 1.19, M. V. .64, P. E., .53. For the left hand, the average was 1, M. V. .56, P. E. .47. The 100 percentile score for both hands was 3, the 0 percentile 0, and the 50 percentile score 1. (Tables III, IV.)

Test No. 29. Steadiness II. The apparatus used in this test for steadiness of hand while in motion, was the tracing board, also furnished by the Stoelting Company. Two straight metal strips are mounted on glass, the distance between them diminishing from five mm. at one end to two mm. at the other. A wooden rule is mounted on the metal strips. A metal stylus completes the apparatus which, when wired in circuit with a bell, is ready for use. It is placed on the table directly in front of the child, who is given the stylus and asked to draw a line from the wide to the narrow end of the slit. If the stylus touches the metal strip on either side of the slit, the bell rings. The rule allows a reading of the distance covered before contact is made. The test was made with both hands, the right hand moving from left to right and the left hand moving from right to left, the position of the board being reversed for each change of hand. The score was the longest distance drawn without making contact, three trials being allowed, after an initial practice.

Forty-two children were tested. For the right hand the average was 6.47, M. V. 3.29, P. E. 2.48. For the left hand the P. E. was even greater and the results are omitted in the report. The 100 percentile score for the right hand is 15, the 0 percentile 0, the 50 percentile 7. (Tables III, IV.)

Tests No. 30 and 31. Target Test. For accuracy of aim, or the target test, we used the apparatus described above for tests No. 27

and 28, having the child place the stylus in the first four holes, according to rhythmic counting, 1, 2, 3, 4. This test was more successful than the steadiness tests, and the children enjoyed it more. Both hands were tested, alternate hands being used for successive trials, and three trials being given each hand. The score was the smallest hole entered without contact in the best of three trials.

The average attained by the 43 children tested was, for the right hand, 2.21, M. V. .69, P. E. .58, and for the left hand, 1.7, M. V. .77, P. E. .65. The 100 percentile score for both hands was 4, the 0 percentile 0, and the 50 percentile 2. (Tables III, IV.)

Test No. 32. Vital Capacity. The vital capacity was measured by the Wet Spirometer furnished by the Stoelting Company. This instrument measures the maximal amount of air expelled from the lungs after a full deep inspiration. The subject is directed to take a deep breath, then to breathe out through a tube placed in the mouth and connected with the Spirometer.

By many this may be considered purely a physical test, but the part played by the volitional element is appreciated when the test is applied to feeble-minded or to young children. Many of these children who have excellent lung capacity cannot control their performance sufficiently to demonstrate their capacity by this test, simple as it may seem. The records of vital capacity secured by H. H. Goddard⁸ and E. A. Doll⁸ from feeble-minded children at Vineland, New Jersey, and by Smedley²⁰ and De Busk⁷ for retarded public school children, indicate this fact.

Before letting a child use the spirometer, the experimenter always demonstrated the method in order to give the child an idea of how to proceed. The effort was made to evoke enthusiasm over blowing it high. The enthusiasm was easy to arouse, but it was often necessary to allow the child some time to practice in order to secure any satisfactory performance. Many found it difficult to blow in the mouthpiece and allowed the breath to escape around it, while others gave a series of little puffs, not comprehending that the cylinder was to be blown up in one expiration. The vital capacity of many of our group is no indication of the maximum amount of air taken into the lungs or expelled from them, the record representing a small fraction of this air. The score in these cases is really an index of the mental inability of the child to conform to the rules of the test.

Forty children were tested, the average score being 760 cc., M. V. 204.01, P. E. 172.44. Smedley's 100 percentile score for girls of five is 1150. The highest score obtained by girls of five in our group is 984, which falls between Smedley's 90 and 100 percentile. Smedley's 0 percentile score for the same group is 600, while our lowest scores are 246, 401, 492, and 574. There are four six year old girls in our group, and all of these have scores lower than Smedley's 50 percentile score. (Tables III, IV.)

Tests 33 and 34. Grip. The grip was measured by the Smedley Dynamometer, the instrument being adjusted so that its outer frame rested against the fleshy base of the thumb and the inner stirrup against the second phalanges of the fingers. The test was performed for each child to show him how and he was urged to squeeze harder and harder while he was squeezing. The children all put forth much effort, but much of this went into grimaces and contortions of all sorts. Three trials were given with each hand and the hands were used alternately.

Forty children were tested, the results for the right hand being, average 7.8, M. V. 1.9, P. E. 1.6, for the left hand, average 7.33 M. V. 1.41, P. E. 1.19. For girls of five, Smedley's 100 percentile score for right hand is 13, left hand 11.5. Our highest score for right hand is 11, left hand 9. Smedley's 0 score for right hand is 3, for left hand 2. Our lowest score for right hand is 3, for left hand 4. For girls of six Smedley's 100 percentile score for right hand is 15.5, for left hand 15, while our highest score for right hand is 13, for left hand 12; Smedley's 0 score for right hand is 4, for left hand 4, our lowest being 6 for both hands. Our one seven year old girl gave an eight year 100 percentile score, for the right hand test. She had no fingers on the left hand.

For boys of five Smedley's 100 percentile scores are right hand 16, left hand 15.5. Our highest scores for the right hand are 11, for the left hand 9.5. Smedley's 0 percentile score for the right hand is 4, for the left hand 3. Our lowest for the right hand is 5, for the left hand 5. For boys of six, Smedley's 100 percentile scores are 16.5 for each hand. Our highest scores are 12 for each hand. Smedley's 0 percentile score for the right hand is 5, for the left hand 4. Our scores are right hand 7, left hand 6. Our seven year old boys made a Smedley 50 percentile score with the right hand i. e., 12, and a Smedley 20 percentile score with the left hand,

i. e., 10. Again we found our oldest children, the retarded ones, made the poorest scores. Our scores are consistently lower than those of the Smedley tables.

(g) *Learning*

As one of the most essential abilities for a little child is the ability to learn, we considered it important to include a group of learning tests. Six were used, none of which required ability to read or to write.

A test requiring the substitution of number names in the color naming test and one requiring the substitution of numbers for the names of geometric forms were discarded as too difficult.

Tests No. 35 and 36. Healy-Fernald Puzzles A and B. The Healy-Fernald¹⁰ Puzzles A and B may be used as learning tests. After the first successful placing of the blocks, the child is asked to "Do it again," and this procedure is repeated until the task is accomplished in the least possible number of moves. The child has then learned how the pieces should be placed. The number of trials used in this learning process are recorded together with the time consumed in the last and perfect placing. The efficiency index is computed by the following formula: $\frac{A \times 100}{T} = \text{E. I.}$ A = accuracy and T = time. For an accuracy score, 100 is assigned if only one trial is required to secure success in the least possible number of moves; if two trials are used the accuracy score is $\frac{100}{2}$; if three repetitions are used the accuracy score is $\frac{100}{3}$, and so on. The time consumed in the last, or perfect, placing is used as the time score. Forty children were tested with A. of whom seven failed entirely. For the 33 who finally learned the exact position of the blocks, the average efficiency index is 307, M. V. 152, P. E. 129. The 100 percentile score is 769, the 50 percentile score 250, the 0 percentile 79. (Tables III, IV.)

The Healy-Fernald Puzzle B¹⁰ was used with 40 children, five of whom failed entirely. The remaining 35 attained an average efficiency index of 125, M. V. 65, P. E. 54.9. The 100 percentile score was 350, the 50 percentile score 83, and the 0 percentile score 40. (Tables III, IV.)

Test No. 37. Wiring. The fourth learning test was suggested by the interest the little boys took in the wiring of the apparatus for the steadiness test. A bell was placed in the circuit with the

apparatus, and every touch on the metal plate by the stylus rang the bell. The children were curious to know what made the bell ring and asked questions about it. The examiner told them she would show them and then let them put in the wires. She wired the instrument while they watched, then disconnected it, and told them to wire it again. There were two dry cells, the steadiness tester, the bell and the stylus in the circuit. If the child wired the bell correctly after one demonstration, he was scored 100, and this score was divided by the number of repetitions required. Forty-two children were tested, four failed; the average score for the remainder was 70, M. V. 22, P. E. 19. The 50, 60, 70, 80, 90 and 100 percentile wired it correctly after one demonstration. Although only one demonstration was required, there were different grades of success represented which do not appear in the method of scoring used. Some children made and corrected errors, although they were shown only once. This was a particularly popular test; indeed, it was the invention of the children themselves.

The test requires accurate visual perception of position and movement and a considerable amount of concentration, and it is valuable because it requires no information or understanding of a description. (Tables III, IV.)

Test No. 38. String Games. The sixth and last learning test is one which perhaps has never before been used for this purpose. We have long thought that the Indian string games, which have a wonderful fascination for many children, might be used as a mental test. The learning of these games requires a very accurate visual perception of movement, of position, and of form, and also considerable control over hand and finger movements. The extent of almost any child's experience in the games is the familiar cat's cradle and the saw, and very few children seemed to know even these. A series increasing in difficulty was arranged and the five easier games among them used as a learning test with the kindergarten group. The material required is simply two circles of string (the joining being made particularly smooth), one for the demonstrator's and one for the children's use. The experimenter sat at the right of the child so that the child could face as she did while watching her hand movements. The examiner placed the string on her hand in the fundamental position for most of the

games, took it off, and asked the child to do the same. Three demonstrations were given if necessary and if the child succeeded, a more difficult position was tried.

A credit of 20 was given for each step successfully copied, a perfect score, 100, requiring success in five distinct steps. The series used was: (1) position one; (2) opening one; (3) tent; (4) spearing fish; (5) house. The little ones were interested in these games and much pleased when they succeeded in learning them. Thirty-six children were tested, three failed, the 33 successful ones attaining an average score of 41.8, M. V. 18, P. E. 15. The 100 percentile score is 80, the 50 percentile score is 40, and the 0 percentile 0. The test will, perhaps, prove useful for older children because it calls for accurate perception and much concentration without making any demand upon language or information of any sort. (Tables III, IV.)

The games were taken from a book by Kathleen Haddon, called *Cat's Cradles from Many Lands*.

h. *Suggestibility*.

The suggestion tests are six in number. Two of them are designed to influence judgments—one requiring judgment of the length of lines and one judgment of weight. Two are designed to produce sensory hallucinations one of smell and one of taste. Two aim to measure the tendency to establish automatisms.

Test No. 39. Suggestion of Length. The test designed to influence judgment of length of lines was first used by Binet.⁴ The material consists of a series of horizontal lines drawn on a sheet of white paper at varying distances from the margin. The first line is one inch long, the second two inches, the third three inches, the fourth four inches, the fifth five inches and thirty-two others are each five inches long. The suggestion is given entirely by the order of the first five lines. Each line is very plainly longer than the one preceding it and by the time the fifth line is observed the suggestion that each line of the series will be longer than the line preceding it has been given by the material itself.

The procedure is as follows:—one line is shown at a time, all others being covered. To the child is said, “I want to see how well you can judge length, how well you can tell whether one line is longer or shorter than another line. I shall show you one line at a time and I want you to tell me every time I show you a new line

whether it is longer or shorter, or just the same as the line you saw just before." Then the examiner shows the one inch line, covers it and shows the two inch line, saying, "Is this longer or shorter, or the same?" Then she covers the two inch line, showing the three inch line and saying, "Is this longer or shorter or the same?", then covers the three inch line, showing the four inch line and asking the same question. After the fifth line she shortens the question, saying, "And this one?" Thirty-five children succeeded in performing this task. Of the 35 only one was entirely uninfluenced, judging all the five inch lines as "the same." Twenty-eight children, or 80 per cent, were totally suggestible, giving no judgment of "the same;" three were unequal to the task, not having sufficient power of application to complete it. (Tables III, IV.)

Test No. 40. Suggestion of Weight. The test designed to influence judgment of weight is also an invention of Binet.⁴ The material comprises 15 black wooden bottles, plainly numbered in white on the top, 1, 2, 3, ... 15. No. 1 weighs 20 grams, No. 2, 40 grams, No. 3, 60 grams, No. 4, 80 grams, No. 5 and the other ten all 100 grams. Again the suggestion is given entirely by the order of the material. Each bottle lifted, up to and including the fifth, is very evidently heavier than the one immediately preceding it and that fact establishes the suggestion. The examiner says to the child, "I want to see how well you can judge weight, how well you can tell which is the heavier of two bottles. First I want you to pick up this bottle (lifting No. 1), then to lift this bottle (lifting No. 2) and while you have it in your hand tell me whether it is heavier or lighter than No. 1, or just the same as No. 1. Then put it down, lift up the next and tell me whether it is heavier or lighter than No. 2, or just the same; then put it down, lift the next and tell me whether it is heavier or lighter than No. 3, or just the same as No. 3." She proceeds in this way to the fifth and then says, "And do the same with all the other bottles."

Thirty-five children succeeded in performing this test. Three failed because they could not judge correctly between the difference of the first five weights. Of the 35 who succeeded, one was uninfluenced by the suggestion, judging the last ten weights equal and the other 34 were totally suggestible, not one judgment of equal being given by any one of them. (Tables III, IV.)

Test No. 41. Suggestion of Odor. The test material used for pro-

ducing an hallucination of smell consisted of a little bottle of lilac perfume and another bottle of tinted but unscented water. The child was given the perfume to smell and asked what it was. The usual answer was perfume, but sometimes the child did not know the word perfume and simply said, "good" or "nice". Then the other bottle was presented, with the same question.

Thirty-six children succeeded in performing this test. One failed through lack of attention. Of the 36, 21 (58 per cent) responded to the suggestion, answering that the second bottle contained perfume. Fifteen children could smell nothing when given the second bottle. There is perhaps little doubt that 58 percent of the children were really suggestible, but there is a doubt that an hallucination was present in all cases. In some instances it seemed that the children said they smelled perfume because they thought it was perfume and thought they were expected to smell it, not because they really thought they smelled anything. (Tables III, IV.)

Test No. 42. Suggestion of Taste. The material used for producing an hallucination of taste was similar to that used for producing a sensation of odor. Three bottles, one containing very sweet water, one slightly sweetened water, and one unsweetened water were used. The experimenter told the child she wanted to find out how well he could taste, reassuring him by telling him that what she gave him would taste good. Then with a piece of absorbent cotton she touched his tongue with the sweetened water, which he watched her take from the bottle. He, of course, said it was sweet, or tasted like candy. Then she used the slightly sweetened water, asking whether he could taste the sugar in that, and finally used the unsweetened water, asking the same question.

Of the 35 children who succeeded in performing this test 15 were suggestible, claiming they tasted sugar in the unsweetened water. There was much greater surety of statement regarding taste than smell. The children were clearly less suggestible to taste than to smell. Only 40 per cent were suggestible in comparison with 58 per cent. (Tables III, IV.)

M. H. Small¹⁹ of Clark University, used practically this same method for testing school children en masse. His results are rather startling. He found that in using the test designed to produce the hallucination of odor, 98 per cent of 93 children in the first grade were suggestible and 95 per cent of 62 children in the second grade

were suggestible. In the test designed to produce hallucination of taste 98 per cent of 94 pupils in the first grade and 90 per cent of 70 pupils in the second grade were suggestible. Of course in these tests there was an added element of suggestibility in the behavior of the other children of the class.

Test No. 43. Automatism—Taps. The two tests designed to establish an automatism are borrowed from Rossolimo.¹⁷ The first we call the tapping test. The child is given a pencil and the experimenter says, "I want you to tap with your pencil just as I do. We will tap together ten times." If the child continues to tap after the experimenter stops at ten, the automatism is considered established.

Thirty-eight children performed this test and all of them tapped at least once more than the ten times. The record for this test therefore is 100 per cent suggestibility. (Tables III, IV.)

Test No. 44. Automatism—Eye—Hand. The second test of automatism consists of asking the child to shake hands with his right hand and to close his eyes while he does so. After the lapse of about half an hour during which the child has been otherwise employed, he is asked to shake hands with the left hand. If the suggestion holds, he will close his eyes as he shakes hands. Of 38 children so tested 21 closed their eyes while shaking hands with the left hand. Seventeen failed to do so. Fifty-five per cent of those tested had established in one performance a strong association between the acts of shaking hands and closing eyes. (Tables III, IV.)

These last two tests illustrate how easy it is to establish habits, how rapidly new associations between stimuli and motor responses can be set up. They show how important it is that parents and teachers take infinite care while the children are young to establish desirable motor responses and to guard against the undesirable which are all too easily established.

3. Complex Performance Tests

Test No. 45. The Maxfield Cube. The Maxfield cube test is so named because Dr. Francis Maxfield introduced it, although the actual patterns used by us may not be the same as those used by Dr. Maxfield. The cubes used are the color cubes sold by the Bradley Co. They are one inch cubes and present one blue, one yellow, one red, one white surface, one surface blue and yellow, and

one red and white, the colors on the last two surfaces meeting at a diagonal. These blocks lend themselves readily to the formation of geometric designs of varying degrees of difficulty. Four blocks were used, each child being given four similar ones. The blocks were arranged in a pattern on a table before the child and he was asked to make a pattern like it with his blocks. The patterns used were the following:

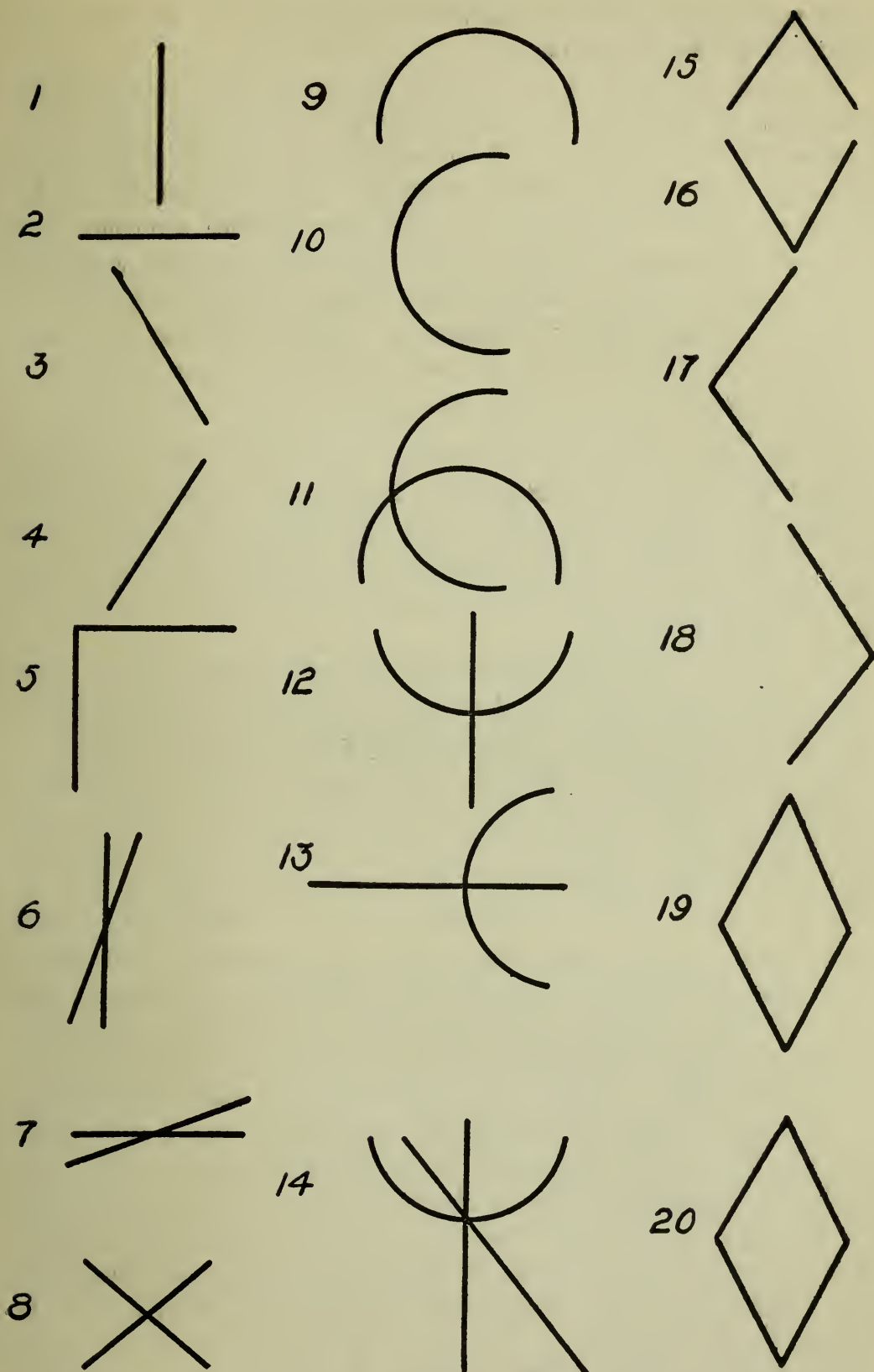
1. Solid square of one color
2. Square of yellow within square of blue
3. Two white tents or soldier caps, one under the other
4. A diagonal stripe of white on a red surface
5. A chevron of yellow on a blue surface
6. A pin wheel.

Success in forming all six designs gave a score of 100, each success contributing 16.66 toward the score. Forty-five children performed the test, the upper 20 per cent making a perfect score, the 60 and 70 percentiles making 83.3, the 40 and 50 percentiles 66.64. Av. 67.02, M. V. 23.35, P. E. 19.74. (Tables III, IV.)

The test requires in its performance accuracy of both color and form perception, the ability to perceive slight differences of form and position in a pattern containing several varieties of both, and the ability to analyze the total perception into its block units, concentrating on each in turn to the exclusion of the others. It was considered too complex to be included in the group perception tests. Care was taken in that group to isolate as much as possible each form of perception. Good scores are often made in the perception tests by children who can do little with the cube test.

Test No. 46. The Seguin Formboard. The older Witmer model of Seguin formboard was used, the same board as that used by Dr. Sylvester²¹ in his experiments. As our children are only five years old, the Sylvester norms are not applicable and a slightly different procedure was adopted.

Each child was allowed to repeat the test up to the limit of ten times until he had succeeded in one trial in placing all the pieces without errors. The child was shown that each block fitted into one hole and one only, and was then told to put them all in, each in the hole in which it belonged. Before the second attempt the examiner said, "Now let's try it again, and this time you will do it just as well, and a little quicker." Sometimes even this mild suggestion of



haste spoiled the accuracy, but often it had no effect whatever, the child not attempting to hurry.

A record was kept of the number of errors made and the time consumed in each trial. In computing an efficiency index the number of trials instead of the number of errors was used as the accuracy index, and a child's accuracy index was determined by dividing 100 by the number of trials used before accuracy was attained. For instance, child No. 3 placed all blocks correctly without error on the second trial; her accuracy was 50. Child No. 4 used six trials before attaining a perfect performance; her accuracy was 16.66. For the time-score the time of the last trial, a perfect performance, was used. The formula used is $E = 100 \frac{A}{T}$. $A = \frac{100}{\text{No. trials}}$; $T = \text{time of last trial}$. Child No. 3 used two trials; time of the last trial was 28 seconds, therefore $E = 100 \frac{50}{28} = 178$.

Forty-two children performed the test, three failing to attain a perfect performance in the ten trials allowed. The efficiency index ranged from 45 to 333, the average was 158, M. V. 70.9, P. E. 59.9. (Tables III, IV.)

Test No. 47. Line Reproduction. Lines and combinations of lines were drawn before the child one at a time with the instruction that he draw one like it. The accompanying lines were used. A credit of 2.5 was given for Nos. 1, 2, 3, 4, 9, 10, (one line figures) a credit of 5 for Nos. 5, 6, 7, 8, 11, 12, 13, 15, 16, 17, and 18 (two line figures), and a credit of 10 for Nos. 14, 19 and 20 (three and four line figures, presenting difficult angles). The performance of this test involves visual perception of the position of lines, complicated by the reproduction of this perception graphically. Involving as it does the coördination of hand movements, this test does not depend upon visual perception so much as upon the power of visual perception to direct and control hand movements. This control may be weak on account of poor visual perception, or on account of lack of association between the visual perception and the idea of the movement to be made. Success in this test might be expected to indicate ability to learn to write, as it calls for the same combination of abilities in a simplified performance. If this expectation is realized the test will be a valuable prognostic test, inasmuch as it will indicate the probable ability of a child to succeed in school work.

Thirty-eight children were tested; the lowest score was 13.5,

the highest 90 (attained by the 100 percentile only), the median score was 47.5, the average 48.7, M. V. 19.8, P. E. 16.7. (Tables III, IV.)

Tests No. 48 and 49 have been discussed under General Intelligence Tests, page 38.

Test No. 50. The Knox-Pintner Cube. For this test four black cubes from the Stoelting Co. Binet set were used. They were placed on the table before the child and he was given a pencil and told to "Do just what I do after I have finished." Pintner's¹³ order of touching the blocks was adhered to and his age level scoring followed.

Success seems to depend upon power of concentration and accuracy in perception of position and movement. This analysis is somewhat vitiated, however, by the fact that if the subject happens upon the trick of numbering the blocks 1, 2, 3, 4, and remembering the number names of the successive blocks tapped, the process becomes largely one of verbal memory and is much simplified. Forty-four children were tested and their age scores compared with their chronological age. The variation in performance was so great, ranging from two years less than chronological age to 11 years in excess of it, that the results throw some doubt upon the claim that the Pintner norms are correlated with chronological age. The results are presented in graphic form in Chart 1. The graph shows three modes. The largest group, 13, made exactly their chronological age score; only four failed to make a score corresponding to their chronological age, the other 27 exceeding it from 1 to 11 years. (Tables III, IV.)

Test No. 51. The Porteus Maze. The Porteus Maze test, or the motor intellectual series, as Porteus¹⁴ originally designated it, consists of a graded series of mazes of increasing difficulty, adapted to testing children of ages six to 14 inclusive. These mazes are preceded in the series by three simple tests which call for the drawing of outline figures between the guide lines, for the years three, four and five. The figures are diamond, four pointed star, and maltese cross. Porteus claims that the successful performance of these tests depends upon prudence and forethought, mental alertness, and sustained attention. These qualities, he writes, are left untested by the Binet intelligence scale and he offers this motor intellectual series as a supplementary test to make more complete the estimate of the child's mentality. Porteus, however, in

his latest monograph on the maze test, September 1919,¹⁵ has revised the series, substituting new tests for six and seven years of age, shifting the old five year test to four years, the old six year test to five years, and discarding the original four year test. The change, of course, affects the scale most at just the levels used in our investigation, and our age scores might have shown a greater correlation with chronological age had the new series been used. .

Our results are scored according to the original Porteus¹⁴ method and compared with his original norms attained by the examination of a thousand children in Melbourne, Australia. Three of the 43 children examined by us passed just at age, three one year below age and the other 37 ranged from one to eight years in excess of their chronological age. The results are presented in graph form in Chart I. There are two distinct modes, one at two years above chronological age, twelve cases, and one at four years above chronological age, eleven cases. These results show little correlation with chronological age. (Tables III, IV.)

VI. TYPE CASES

In order to gain a knowledge of the social setting of each child, it was our plan to have a person trained in the work of social investigation visit each home and learn those facts about the family life which would help us to an understanding of the child's characteristics and of the influences which had been moulding him during the five short years of his experience. No such person was available, and in order to complete the study, which had already nearly reached its goal, the writer undertook to make the visits to the homes herself. As a result, she has in mind in thinking of each child a picture of him as one of a home group which is quite as vivid as her picture of him in the schoolroom or in the laboratory. The picture of B. D. is that of a little child stamping into the house demanding that her mother give her a piece of bread at once; it is followed by one of the mother's worried face as she comes to the office at four in the afternoon in the midst of a snowstorm, in a vain search for the child, who already at five thinks she can manage her affairs far better without her mother's aid. E. is thought of in a cluttered, dirty, hopeless room into which she led the way to the mother's evident shame. The setting of the picture of D. is a tiny home, very pretty, in immaculate order, a beautiful and happy young mother enjoying her baby and finding

ample time to keep her house and make her clothes, and care for her three children. "I do not have too much to do," she said. "I think it is because I plan my work."

The children were, for the most part, children of working men, men employed in factories, on the railroads, and in the shops. There were a few salesmen and one professional man. The majority of the families lived in small wooden houses with porches, and sufficient rooms for comfortable living. The house work was done by the mothers, who seemed to have sufficient money to live comfortably on this modest scale. Most of the houses indicated that there was a little more than enough money than was required for absolute necessities. In many of the homes there was a victrola, a few had a piano, and most of them displayed articles of various kinds whose chief function was to beautify the home. There were a few families that shared their houses with other families and evidently had more difficulty in meeting the absolute expenses of life. On the whole, all the children came from homes of about the same economic level. The individual differences in the home environment, which were very striking, depended evidently upon the intelligence and temperament of the mothers. All of the mothers were endeavoring to make the home conditions as comfortable as possible, but some of them were sadly in need of knowledge which would have enabled them to succeed, and some of them were lacking in the force of character which is necessary to bring up a family of children in an intelligent manner.

There is a current notion that the native intelligence of an individual decides the social and economic level to which he attains. Contact with the mothers and fathers of this group of children leads one to doubt the truth of this theory. Among these people, who are likely to remain at their present social and economic plane, were found men and women of superior mental endowment, who, if their careers had started on a higher cultural and economic level, would doubtless be filling a place in the professional world today. It is not poverty of mental endowment which keeps the parents of this special group where they are; it is poverty of mental experience. They were not unintelligent, but untutored and uncultivated.

We are not presenting a statistical report of the social findings, as their value lies wholly in the relation of conditions in the individual homes to the quality, mental and physical, of the

children these homes have sent to the schools. Instead, short sketches have been prepared for each child, which state the salient facts gleaned from the family visits and the physical and mental examinations, and are aimed to present a fairly complete picture of the individual children. A few typical sketches follow.

Child No. 1. Johnny was the first child brought to the office because he was an unsolved problem in the schoolroom. The difficulty was that the child refused to talk, his efforts limiting themselves to pronouncing his own name. During the first fifteen or twenty minutes he did all that was asked if no speech was required. He answered all questions that a nod or shake of the head would dispose of, but he spoke no word. Finally, when all toys and games had failed to appeal, he was asked, "What would you like to do?" and the answer came in a burst of tears, "Go home." He was told, "Of course you may go home if you want to," and while he was being comforted and his coat put on he talked a little. This talk revealed an infantile stammer. In the afternoon the mother came to see what was going on, and brought her younger boy with her; the two children chattered together in a language unintelligible to others. The younger brother never uses this form of talk except to Johnny. The mother does not like Johnny to talk so queerly and tries to shame him out of it. The result is a self-consciousness which prevents Johnny from talking at all. The mother's attitude is a little resentful that Johnny is as he is, and a little resentful that we notice it, and she unconsciously lets this feeling affect her treatment of the boy. The home is a second floor flat. The father is of Swedish parentage. There is plenty of money to buy the necessary food, but the mother is of the opinion that children should not be made to eat anything which they do not like. The house is clean and well kept, as are the children. There is no attempt to beautify the home, but its bareness is more an indication of lack of feeling for beauty than of poverty. The boys play together constantly and are much on the street.

Johnny was a healthy baby, was nursed by his mother, and has never been seriously ill. He is quite cross-eyed, and an examination of his eyes revealed the fact that the vision of one eye is four-tenths, and of the other one-tenth. His tonsils are very large, he needs circumcision, he has flat foot, bow legs, protruding scapulae, eleven carious teeth, and the haemoglobin content is 75. Johnny is a little overweight, and it would seem, must have much physical vigor to

withstand as well as he does so many physical defects. The mother at once had his eyes examined and procured glasses; the other defects have not been remedied.

The mental examination revealed as many weaknesses as did the physical. At only six points does his profile curve pass the 50 percentile. One of these points shows no ability, but as it was a suggestion test in which the whole class followed the suggestion, the 100 percentile really means participation in class failure. One suggestion test was successfully resisted, the 60 percentile was reached in one discriminative attention test, and the 70 percentile in the other. The 60 percentile was also reached in the picture memory test, the 70 percentile in the first steadiness test for the left hand (which is his preferred hand). The peaks are rare in this profile, which occupies almost constantly the lower part of the graph. In all the performance tests and in the general intelligence tests he falls behind, testing just at age or in the 30 percentile by Binet, and one year retarded or in the 0 percentile by the Stanford revision. He graded at the 50 percentile in the Knox-Pintner cube test, and the 0 percentile in the Porteus test.

The physical and mental pictures of this little boy are strikingly similar, defects being so numerous that one almost despairs. Nevertheless, there are so many points of attack for helping Johnny that there is much to do before we give up. The mother is worried over him and will do all that she is convinced is right to do. She feels that the school should provide special training for children with such speech defects, and rather resents being told that Johnny should have special training when the schools obviously do not provide it.

Without the correction of his physical defects, and in addition special training, the prospect for Johnny is not good. With these it is possible that much may be done to help him.

Child No. 2. Anna is a little girl who came to us on her fifth birthday. She is fat, rosy and six pounds overweight. She was a healthy breast-fed baby. At six months she had whooping cough and developed eczema on her head and body, which has continued in spite of various treatments ever since, though now it is confined entirely to her body.

The home is a very comfortable working man's home, a small wooden house with porch, the kind common in this neighborhood. The house is furnished well with some thought to decoration, but

almost too plentifully supplied with pictures. There is a piano and the young mother is studying music. The parents are socially inclined and "go a great deal" in the evenings, always taking Anna because she can not be left alone. She gets very little sleep, taking no nap and going to bed late. She drinks no milk, eats principally potatoes and gravy and fruit.

She is a bright, happy, little thing and shows no nerve signs in spite of loss of sleep and poorly balanced diet. Medical examination, however, revealed a heart murmur and enlarged tonsils and adenoids. The haemoglobin content is 95, the highest for any child in the group. Her psychic profile shows a rather even fluctuation above and below the median percentiles. Her lowest scores occur in imagination and psycho-motor ability. In general intelligence she tested just at age, both by the Binet and Stanford Revision Intelligence scales. Strong in attention, she scored five years beyond her age in the Knox-Pintner Cube test, but this only puts her in the 80 percentile group.

Medical care, change of diet, and regular hours are greatly to be desired for this little girl. Although she does not now to any great extent show the bad effects of the unwise home regime, it can hardly be expected that many years will pass before very grave results will be evidenced. The greatest lack in this home is a knowledge of the proper daily routine for a child. She receives devoted care, but it is very unwisely directed. There is no doubt of her future satisfactory mental progress.

Child No. 3. Sophie is the picture of health, four pounds heavier than the average for her age, with rosy cheeks, bright eyes, and an alert, emotional and lovable disposition. She has an infantile stammer which persists because she uses it in a very appealing way which brings an appreciative smile from all hearers. Unfortunately, a careful medical examination did not justify the appearance of abundant health. The bright eyes had not quite perfect vision, the cervical glands, the inguinal glands, the tonsils and adenoids were enlarged, there was a heart murmur and two teeth were decayed. The haemoglobin content was however, rather high—83.

The mother reports that Sophie did not have a very good start in life; the birth was difficult, the child small and sickly and the mother had not sufficient milk to nourish her. She has suffered no serious illness since.

The mother was much disappointed in the medical report because

Sophie is the baby and the pride of a very happy and united little family. The parents are Russian Jews, the father a junk dealer. The home, which is of the usual small wooden type, is not only comfortable but attractive. The family spirit is very beautiful and the attitude toward strangers cordial and hospitable. Sophie drinks one quart of milk a day and it is very evident that there is plenty of good food for the child.

Sophie's emotionalism showed itself in an outburst of temper. She thought herself deceived and slighted by her older sister and stamped and sobbed and would not be comforted. The mother had little control over her. The child is much loved and the sweetness of her nature has been developed thereby, but unfortunately, not her self-control.

The psychic profile lies for the most part high on the chart, although the imagination drops very low and also the vital capacity. In general intelligence she is a year in advance by the Binet series, and just at age by the Stanford Revision.

Sophie's chief need is that her parents be guided to give her proper medical, dental and hygienic attention. The parents desire to do well for their children, but they are themselves at the point where one hot bath a week seems sufficient and the cleaning of teeth is entirely overlooked. Special training should be given at once to terminate the infantile stammer, which if it continues, is very likely to interfere with her mental progress. With medical care and speech training provided, satisfactory mental development is certain.

Children Nos. 4 and 5. Erma and Effie are twins, and the only children of the family. They are tall and thin, rather pale and breathe through their mouths. All that is said of one may be duplicated for the other, for they are almost identical in appearance, voice, gesture, temperament and mental type.

The home is an exceedingly comfortable one, kept so by thrift and industry on the part of the mother. She makes attractive dresses for the children, sometimes, according to the little girls, "from our grandmother's." She also crochets lace for sale among her friends. There is a piano and a victrola in the living room. The mother manages the little girls as well as she manages the home economy; they are well behaved, obedient and go to bed every night at eight o'clock. They give the mother no trouble, are tremendously

interested in her fancy work and in all that she does, and are demonstratively affectionate toward her.

The mother is of German descent. The father's ancestry is obscure. The children were delivered by instruments, they were nursed by the mother and have had no illnesses, not even the ordinary children's diseases.

In spite of this account of good health, the medical examination confirms the general impression the children give of poor physical condition. It shows enlarged tonsils, adenoids and cervical glands, malnutrition, umbilical hernia, flat foot, protruding scapulae and many carious teeth, among which are permanent molars. The quality of their voices is spoiled by the enlarged adenoids, which prevent nasal breathing, and their beauty is marred by their open mouths. The undernourished condition is probably largely due to the absorption of pus from tonsils, adenoids and teeth. The problem is serious because the father resents even a physical examination of his children. An effort should be made to reach the father and to convince him of the physical needs of his little ones, and the inevitable suffering their neglect will bring upon them.

Both little girls have reached the same general intelligence level, scoring the 100 percentile in the Binet series, and the 90 percentile in the Stanford Revision, thus showing a two and a one year acceleration. Their psychic profiles are alike in type. Their mental ability is undoubtedly of a high order.

Child No. 7. Edwin would attract attention anywhere with his keenly alert, strangely mature little face and undersized, undernourished little body. He is entirely lacking in childishness; no trace of the baby remains, although he is but five years of age. He is a little on the defensive, distrustful of strangers and entirely determined to do as he pleases.

The physical examination showed him to be five pounds lighter than the average for his age, to have a haemoglobin content of 75, to be partially deaf in the right ear (the result of former middle ear disease), and to have a slight scoliosis, with protruding scapulae. He had already been circumcised.

The mother, who is a woman of refinement and ambition, although without much education, is almost in despair concerning the boy, who from the first has been a nervous, irritable, sickly little thing. He is the only child living, coming to the mother late in life after she had lost several babies. The birth was difficult, the

mother's milk did not agree with Edwin nor did other food, and he has always had great trouble with constipation. The mother, instead of regulating his food wisely, constantly resorts to laxatives. On account of his sickliness he has been humored until now he is entirely beyond his parents' control. He eats what he chooses irrespective of consequences and the mother is unable to prevent him without precipitating such a scene that she prefers to keep the peace. The mother is of English parentage, the father probably of Irish descent. There is money enough and good will enough to do all possible for the boy, but his training has been wrong from the start and the child now has full control of everything but his temper.

In the intelligence tests, Edwin reached the 70 percentile with the Binet tests, which signifies an acceleration of one year, and the 60 percentile in the Terman Revision, signifying his chronological age level. It was impossible to make a thorough mental analysis in Edwin's case because he absolutely refused to cooperate.

Child No. 8. Isadore is an only child. The father is a mechanic of Swedish descent. He measures six feet two inches, and is physically a splendid specimen of manhood. His mind is no mean match for his body, and had circumstances started him in a different groove he could easily have qualified for a profession. The mother is Pennsylvania Dutch.

The home is a good one. The furnishings are of good quality, the pictures well chosen and the rooms tastefully arranged.

Isadore is very lively and energetic, and the mother fears that he will find out that his will is stronger than hers. He was a healthy baby, nursed by the mother. His only illnesses have been mumps and measles. He drinks plenty of milk and is a well brought up, attractive boy.

The physical examination shows enlarged cervical glands, adenoids and tonsils, a slight dullness of hearing, a haemoglobin content of 72, and protruding scapulae. He needs circumcision. As the parents are decidedly intelligent and much interested in our efforts to help the child, Isadore will probably be given the individual aid which he needs.

His mental profile shows very few dips into the lower half of the graph. In general intelligence he only made the 30 percentile on the Binet test, and the 60 percentile in the Stanford Revision. This is exactly his chronological age grading.

Child No. 9. Daisy, aged five, has the independence of a woman of forty. She wishes no interference to detract from the effect of her own personality. On entering kindergarten for the first time, she decided to go alone, and she wishes to choose her own clothes and her mother's too, for that matter. Her parents are American. The mother is attractive in person and very mild and unassertive in temperament. The father is a farmer and is away from home a great deal. The mother is not very well. She has rheumatism, in the hope of relieving which she has had her appendix, tonsils and several teeth removed. The home is very small. It is very clean, but only moderately neat and comfortable.

The child has absolutely no respect for her mother's word or opinion. The mother realizes this and complains that the father has always spoiled the child by allowing her to do whatever she fancies. He began when she was an infant by insisting that the mother drop everything and take her up whenever she began to cry. The health crusade appealed to the child and led her to demand milk and cocoa for the first time. Previously she demanded tea and coffee in spite of her mother's protests. Now she as determinedly refuses to touch them. She sleeps ten hours each night. She is five pounds heavier than the average for her age and her only physical defect apart from the low haemoglobin content (75) is very defective vision. The mother had this corrected by glasses immediately upon being notified of the condition.

Daisy's psychological profile shows a weakness in imagination and in the perception of grays. Her general intelligence, which is at the 70 percentile in the Binet series and the 60 percentile in the Stanford Revision, is by the former two years accelerated and by the latter exactly at her chronological level. The most remarkable thing about the child is her tremendous self possession and independence. She was most valuable to us as a pilot for all the shy youngsters and helped us over many difficult places with them. Her confidence in herself has evidently been gained at the cost of respect for her mother. She is, however, of a sunny bright nature which makes everyone like her in spite of her abnormal amount of assurance. Guidance by a wise strong woman is what is needed for Daisy.

Child No. 10. Theodore is the last of four children. The parents are of English descent. Both parents are people of native refinement, but the cost of living has proved too much for them and the

pinch of poverty is plainly visible. All four of the children are mouth breathers. They all have enlarged tonsils, adenoids and an offensive nasal discharge. Fortunately, the parents were glad to send all the children to the Children's Hospital in Iowa City. Theodore's tonsils and adenoids were removed and his antrum punctured. Just one month later he had to return for a second puncture of the antrum. His medical examination also showed enlarged cervical glands, a haemoglobin content of 76, weight two pounds under average and flat foot.

The mental examination revealed a general backwardness and a psychic profile which repeatedly dipped below the median and was particularly poor in imagination, judgment and psycho-motor control. In general intelligence he ranked among those at the 0 percentile by both the Binet and the Terman scales which means one year retardation. We could hardly expect any other result with the physical condition above described. Even in the interval between the first and second operation there was practically no physical relief.

Children Nos. 13 and 14. Children Nos. 13 and 14 are brother and sister, whom we will call Sonny and Sarah. They are both fat and beaming, and it is pleasing to see the protecting air of the boy when he brings his little sister just a year younger than he is to school or to the office. The two are the youngest of five siblings. The older three are all girls and all married. The parents are both American born, of English Canadian and Scotch parentage. The father is a laborer and the pinch of poverty is reflected in the poor home and meager furnishings. They are fortunate in having a strip of ground back of the house which the father converts into a kitchen garden in the summer time. This probably accounts for the well fed appearance of the children. The mother is a strong industrious type, and the spirit of the home is splendid.

Neither of the children has had any of the usual children's diseases. Sarah is subject to croup which the mother says is "in the family." Sarah has large and diseased tonsils, enlarged cervical glands, a haemoglobin content of 75 and a slight mitral regurgitation. The left ear drum is dull; the hearing, however, is not affected. The vision is quite defective and there is in addition an incoördination of eye muscles. She is left handed. Sonny has many of the same physical difficulties. He has defective vision, enlarged tonsils, enlarged cervical glands and heart murmur. He also has enlarged

inguinal glands and needs circumcision. He has lordosis and scoliosis.

Such a list of physical defects for two children who, to a casual observer, appear particularly healthy, indicates the necessity of a thorough medical examination of all children when they first enter school.

For Sonny the Binet level is one year in advance of his age, the Stanford Revision just at age. The highest peaks in his psychological profile are attained in attention and psycho-motor ability and in resistance to suggestion; there is a decided dip in imagination and in one learning test, while the tests of the memory and of the perception group show little correlation within the group. Sarah did not make such a good showing mentally. Her intelligence rating was just at age, with both series of tests, but she dropped below the median in nineteen points in her psychic profile; she resisted suggestion well and made other good scores in some of the perception, memory and learning tests, reaching the 90 percentile in the Vital Capacity score. Both children give promise of developing into intelligent individuals, but in order to do so they need immediate medical care.

Child No. 15. Helen is seven years old, a loving and lovable child, but sadly handicapped physically and socially. She was born with a left hand that has only part of the first phalanx of all fingers and thumb. She said, with a pathetic smile, that God wished her hand to be that way. Her family is large and very poor; both her body and her clothing testify to sad neglect. The child objected so strenuously and so tearfully to the physical examination that it could not be completed. Her embarrassment was probably largely due to her uncleanly condition. Even with this incomplete examination, her list of physical defects is long—poor vision, enlarged cervical glands, rales, heart murmur, marked malnutrition, six pounds underweight, with a Vital Index below standard.

Her irregular school attendance made impossible as exhaustive a mental examination as was made of some of the children and therefore her psychic profile shows many gaps. Her intelligence level by the Binet scale and also by the Stanford Revision is just at age. Her age level for the Knox-Pintner cube test drops to the 30 percentile and for the Porteus maze test reaches the 50 percentile.

This is clearly the case of a child backward in school on account of adverse home conditions. She evidently is deprived of the

necessary food, clothing, soap and water, to say nothing of the opportunity for play and joy which are prerequisites of healthy childhood.

Enough sketches have been presented to show that the basis of physical defects and of character defects that may result in school and life failure is already fixed when the child first enters school. Enough sketches have been presented to emphasize the fact that if we desire to start the children in our schools with more equal chances of success we must reach the young mothers and must help them to an understanding of the needs of their children and of the tremendous effect on their children's lives of the habits that are formed during the first five years. The parents must be taught what to feed their children and why, when to put them to bed, and how long to keep them there. They must be made to realize that unless children see and hear clearly, breathe through their noses, have good teeth and good digestions, they need not be expected to succeed in school, or to retain their health and energy long. Parents must be taught just how to form in their children desirable habits and how to thwart undesirable habits. All this knowledge must be made vital for them, and they must be given actual aid in putting it in practice.

If educators would succeed in leading the next generation to the success of which it is potentially capable they must enter the homes and help the young parents in whose care are those first five years so important for the laying of a firm foundation of health and good habits. In order to furnish such guidance, educators must study the children during their first year in school and see to it that those who are handicapped by physical or mental defects or derangements are provided with the medical and pedagogical aid that they require.

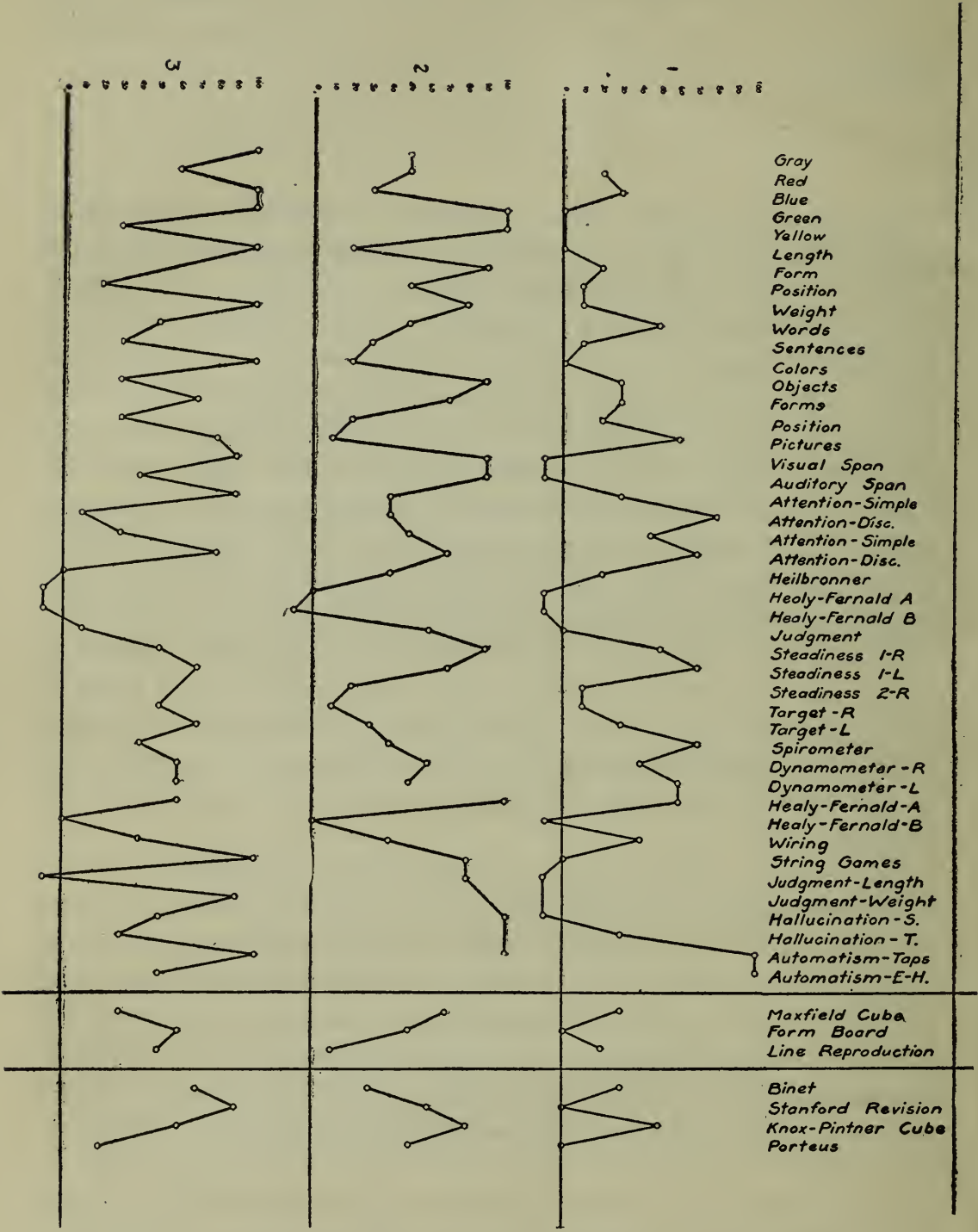


Chart III. Individual Psychological Profiles, 1-3

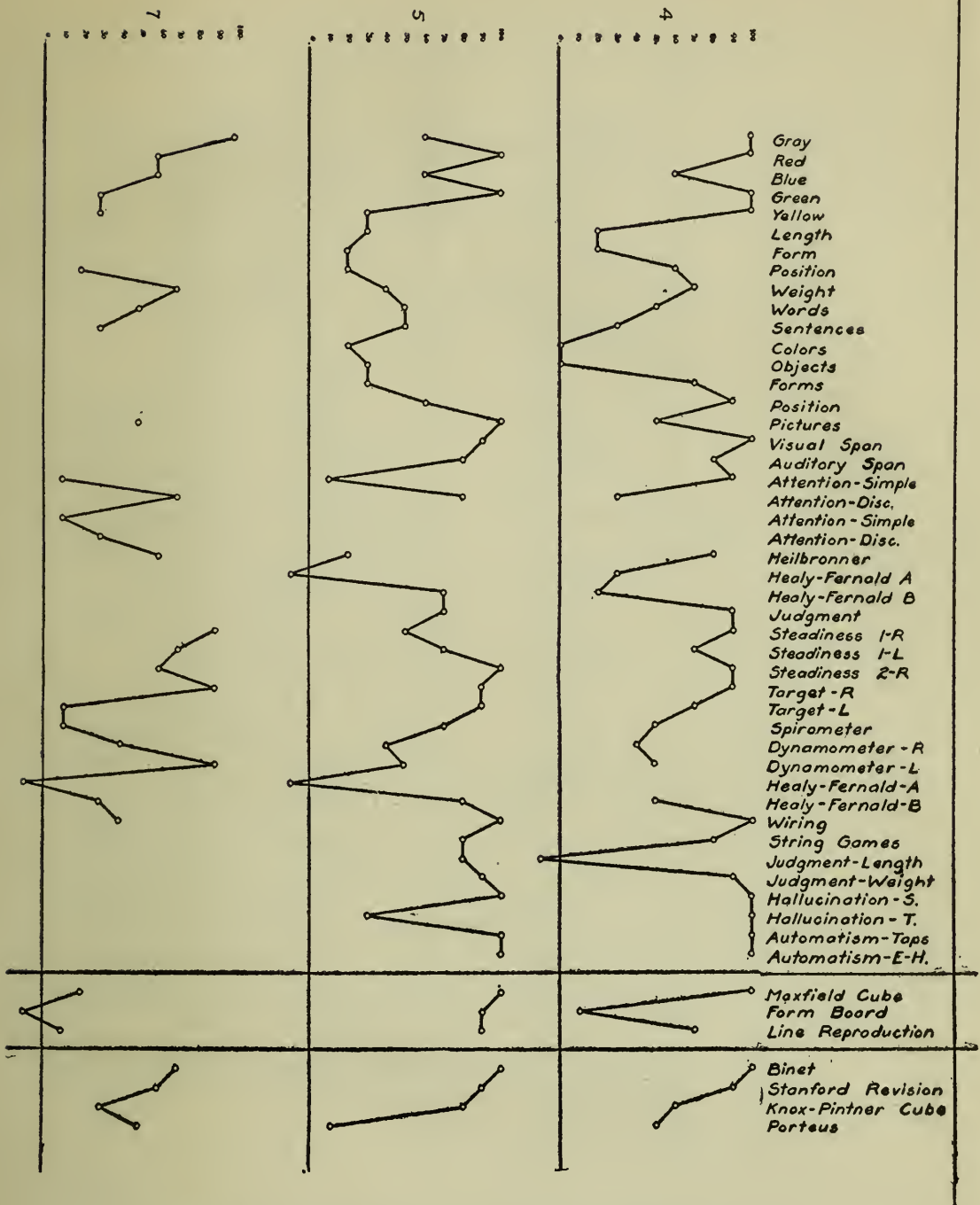


Chart IV. Individual Psychological Profiles, 4, 5, 7,

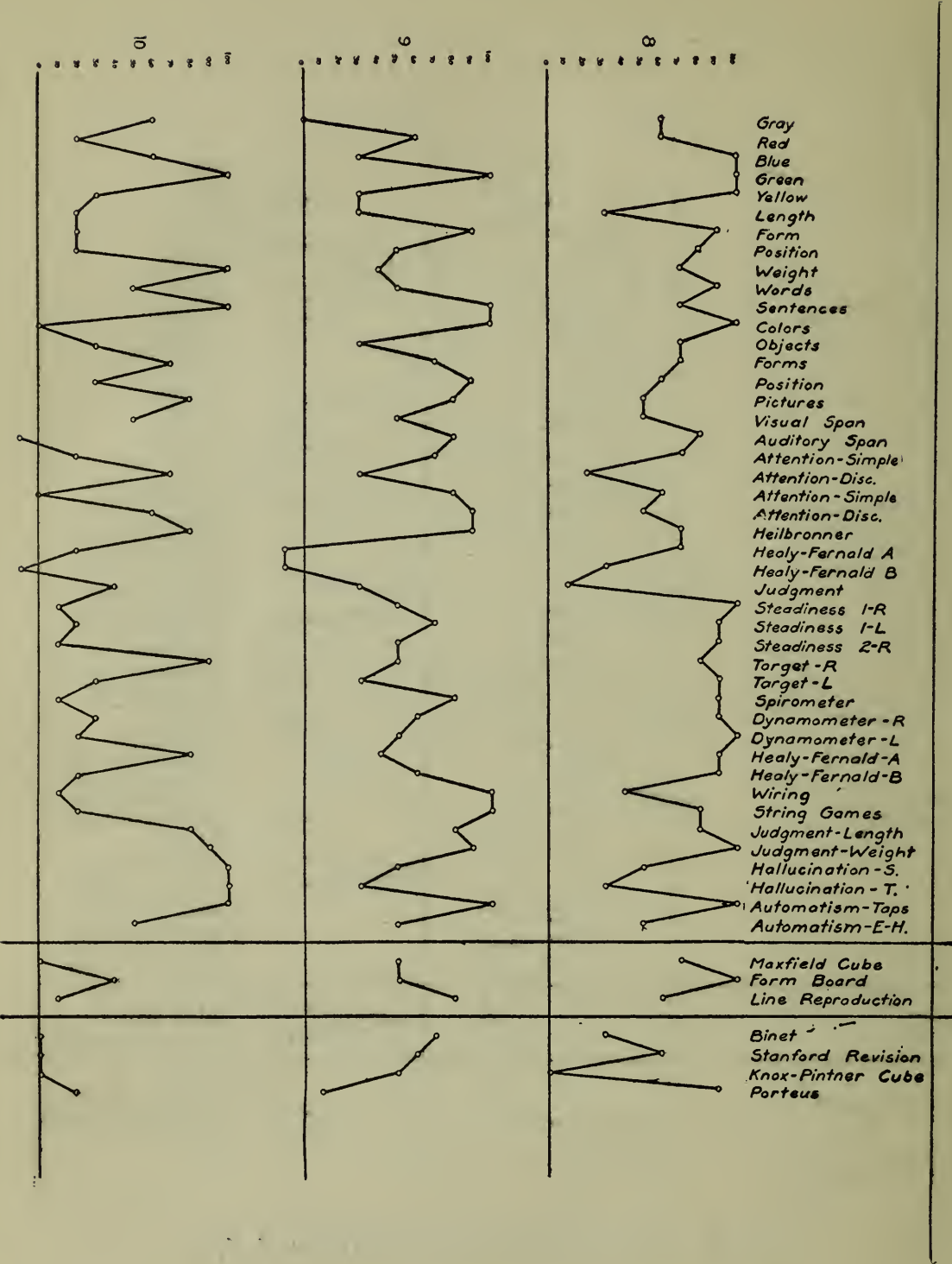


Chart V. Individual Psychological Profiles, 8-10

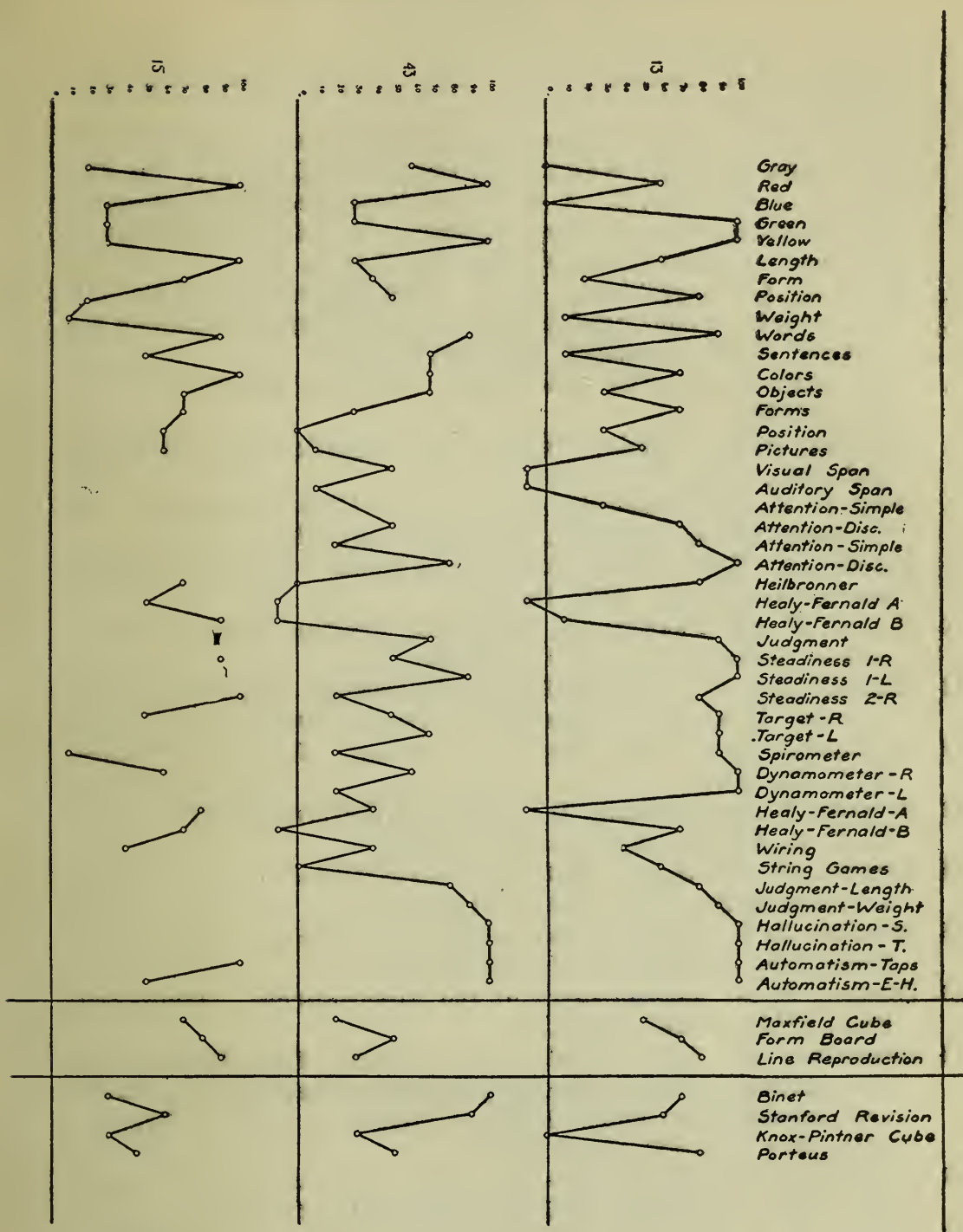


Chart VI. Individual Psychological Profiles, 13, 43, 45

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